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ABSTRACT

This curriculum guide is intended to assist junior and senior high school vocational instructors in presenting a course in manufacturing technology. The package contains a competency/skill and task list, an instructor's guide, and a bibliography. The following competencies are covered: the historical development of manufacturing (the interchangeability of parts, mass production, and the relationship between the economic system and manufacturing); manufacturing and the environment (energy sources, natural and synthetic materials used in manufacturing, plastics, the role of research and development, pure versus applied research, and major manufacturing resources); manufacturing in the future (space-related products, new product research, environmental considerations, automation, computer aided-manufacturing and computer-aided design, human resources, communications technology, and career plans); personnel in technology (the work ethic, employers' and employees'responsibilities to one another, considerations in establishing a worker training program, organized labor and collective bargaining, open and closed shops, labor legislation); industrial arts student associations; manufacturing in technology; management technology; and manufacturing enterprises. Each chapter in the instructor's guide contains introductory concept information and a series of competency sheets. Each competency sheet contains a competency statement, instructor information, and three levels of instructor activities. (MN)

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ARIZONA INDUSTRIAL ARTS MANUFACTURING TECHNOLOGY

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NORTHERN ARIZONA UNIVERSITY

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ARIZONA INDUSTRIAL ARTS

MANUFACTURING TECHNOLOGY

TEACHER'S CURRICULUM GUIDE

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FOREWORD

This competency based curriculum guide has been developed for Junior High and High School Manufacturing teachers. The format was designed by and directed for the use of Industrial Arts teachers.

In the Spring of 1986, Mr. Hoyt Kenmore, State Supervisor of Industrial Arts Education, called together several Curriculum Specialists and Industrial Arts teachers to review curriculum materials that would eventually serve as a central core for curriculum guide development. This was the initial effort in the Arizona Competency Based Curriculum Development effort to target Curriculum Guide materials to various levels of instruction. For this effort, the three levels of instruction included in the Arizona Industrial Arts Program Guide were addressed.

Each competency was written for Level 1, Level 2, and Level 3. These three levels are representative for the three general targets of curriculum design for Industrial Arts programs in Arizona, Awareness, Exploration, and Core Skills.

A sincere effort was made to maintain the integrity of each competency because each competency was identified and then validated by a group of people who are involved in the manufacturing industry.

This material was designed with the manufacturing industry, your students and you in mind. It should provide a resource from which to build a new or updated manufacturing program.

ACKNOWLEDGEMENTS

The Manufacturing Competency Based Curriculum Guide is the result of many people working together to insure quality programs through quality curriculum for students seeking education and training in this area.

Dr. Ray Ryan, Associate Professor, Industrial Technology Department at Arizona State University served as the reviewer, writer and contractor.

The Advisory Committee included the following persons: Scott Bonin, William Fechter, Si Gimble, Hoyt Kenmore, Dr. Ray Ryan, Tom Schildgen, Walt Tamasauckas, Don Wilgus, and Dr. Macke Williams.

We are grateful to the entire staff of the Arizona Center for Vocational Education for their support, concern and assistance. Special thanks to the Curriculum Unit: Dr. Jerry R. Cox, Nancy F. Dillon, Sue Peters and Cass Sandbakken.

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COMPETENCY TASK LIST

1.0 Historical Development of Manufacturing

1.1 Comprehends the concept of "interchangeability of parts"
1.2 Expresses the six steps in the manufacturing process
1.3 Interprets the importance of measuring tools
1.4 Interprets the process of mass production
1.5 Describes the development of manufacturing
1.6 Illustrates why mass production is essential to our economy
1.7 Interprets the relationship of the economic system to the manufacturing system

2.0 Knowledge of the Environment

2.1 Describes six natural energy sources
2.2 Describes four natural materials used in manufacturing
2.3 Discusses two synthetic materials used in manufacturing
2.4 Describes the two classifications of plastics
2.5 Discusses seven forms of plastics
2.6 Explains four advantages of plastics over natural materials
2.7 Describes three functions of a research and development department in a manufacturing company
2.8 Illustrates the terms "pure research" and "applied research"
2.9 Identifies five major manufacturing resources

3.0 Manufacturing in the Future

3.1 Describes three space-related products that are manufactured
3.2 Describes how new products are researched
3.3 Explains three environmental considerations in the manufacturing process.
3.4 Translates the term "robotics"
3.5 Distinguishes between the terms "CAD" and "CAM"
3.6 Interprets the term "automation"
3.7 Designs a floor plan for a manufacturing plant
3.8 Designs five new products for future manufacturing
3.9 Describes three changes in communications over the past ten years
3.10 Explains the five basic needs of humans
3.11 Prepares a four step personal career plan
3.12 Locates four occupations in the Dictionary of Occupational Titles

4.0 Personnel in Technology

4.1 Interprets nine elements related to the "work ethic"
4.2 Describes six responsibilities of an employee to an employer
4.3 Describes six responsibilities of an employer to an employee

4.4 Identifies three major considerations in establishing a worker training program
4.5 Describes eight careers in the manufacturing industry
4.6 Explains the term "collective bargaining"
4.7 Explains the term "organized labor"
4.8 Describes four examples of employee fringe benefits
4.9 Develops a line-staff organizational chart for a small manufacturing business
4.10 Explains an "open shop"
4.11 Explains a "closed shop"
4.12 Describes three examples of technological advances in the manufacturing process in the past ten years
4.13 Explains the "right to work" law
4.14 Develops a brief personal work resume

5.0 Industrial Arts Student Associations

5.1 Comprehends the use of Robert's Rules of Order
5.2 Demonstrates the ability to arrange for speakers or plant visitations in the field of manufacturing
5.3 Demonstrates the ability to conduct descriptive career research in industry, using a survey by mail, or a questionnaire during an interview
5.4 Demonstrates the ability to organize and manage a profitable enterprise that produces a product or renders a service of educational value
5.5 Demonstrates the ability to plan, organize and execute an activity or project that benefits the school and/or community
5.6 Demonstrates the ability to communicate with a community organization to determine need for a product or service
5.7 Demonstrates the ability to participate in a competitive event to learn industrial arts and earn recognition for achievements
5.8 Demonstrates the ability to organize an open house with project exhibits and a manufacturing demonstration

6.0 Manufacturing in Technology

6.1 Describes four natural resources and explain how each is obtained
6.2 Explains the process of converting natural resources to standard industrial stock
6.3 Explains the process of converting recycled resources into standard industrial stock
6.4 Discusses four occupations related to standard stock production
6.5 Defines automation related to manufacturing
6.6 Describes the process of "tooling-up" for production
6.7 Identifies four engineering jobs related to "tooling-up"
6.8 Defines "jigs" and "fixtures"
6.9 Describes a mechanical fastening process
6.10 Describes a welding process
6.11 Describes a bonding process
6.12 Describes a molding process

6.13 Describes a casting process
6.14 Describes a forming process
6.15 Describes a laminating process
6.16 Describes a cutting process
6.17 Explains layout and measurement
6.18 Outlines the process of combining components
6.19 Explains the distribution process and the relationship of packaging, labeling and storing
6.20 Discusses five service occupations related to the manufacturing industry

7.0 Management Technology

7.1 Identifies occupational levels of industrial management
7.2 Explains the importance of profit in free enterprise
7.3 Charts the levels of authority within a corporation
7.4 Outlines the management planning process
7.5 Explains the utilization of computers in management
7.6 Describes five examples of computer usage in manufacturing
7.7 Describes five steps in the manufacturing planning process
7.8 Describes five administrative examples of data processing
7.9 Explains the purchasing function as it relates to manufacturing
7.10 Describes four methods of cost control
7.11 Discusses six reasons for profit
7.12 Discusses four reasons for sales forecasts
7.13 Explains three means of identifying consumer demands
7.14 Describes six concepts within the marketing function
7.15 States the five steps in the problem solving method
7.16 Describes the steps involved in research and development
7.17 Describes four reasons for the use of prototypes in the manufacturing process
7.18 Designs a small manufacturing facility (using a flow chart and instructor provided information)
7.19 Describes five occupations in production planning
7.20 Estimates the cost of a group manufacturing project
7.21 Performs a time and motion study
7.22 Describes production control in the manufacturing process
7.23 Describes quality control in the manufacturing process

8.0 Knowledge of an Enterprise

8.1 Defines the term enterprise
8.2 Explains management's responsibilities to owners, employees, customers and the general public
8.3 Describes the three types of ownership
8.4 Describes capital as used in manufacturing
8.5 Defines the term management
8.6 Interprets the meaning of incorporation
8.7 Describes an organizational chart for a small corporation
8.8 Explains at least four steps in planning an enterprise

8.9 Identifies six responsibilities of an employee to an employer
8.10 Explains why manufacturing lends itself to big business
8.11 Describes five start-up problems facing an enterprise
8.12 Describes the three main functions of Research and Development for a new product
8.13 Explains the six steps involved in new product development within the research and development process

CONCEPT: 1.0

HISTORICAL DEVELOPMENT OF MANUFACTURING

CONCEPT INFORMATION:	To address this concept the teacher should provide activities and instruction covering the following topics.
Custom Production (Cottage Crafts)	Making complete items one at a time. No two items may be identical (small quantities produced). In the late 1700's each person had to make everything needed; clothes, shoes, tools, etc. Machines started to take the place of hand tools during this time.
Job Lot Production	Specialty shops make quantities of one item. Many shops, each produce specific parts (Limited numbers are produced).
Line Production	The item is moved down a line and each worker assembles a specific part (Large quantities are produced).

COMPETENCY: 1.1 Comprehends the concept of "interchangeability of parts"

INSTRUCTOR INFORMATION:

Interchangeability of parts: The industrial concept of making quantities of identical parts so any one part can be assembled to adjoining parts. All pieces must fit together and work properly. Parts must be accurately (precisely) made to be interchangeable. Replacement parts can be produced cheaply and quickly. Assembly procedures are simplified through standardization of sizes.

Interchangeable parts may be picked at random (by chance) during assembly. The opposite of **interchangeable parts** would be custom designed parts (one of a kind).

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the concept of **interchangeability of parts**:

Bring in some examples of this concept to show students such as:

1. Screw on beverage caps from different brand name products
2. Automobile tires
3. Fasteners, i.e. screws, nuts, bolts
4. Hacksaw frames and blades
5. Cassette tapes (from various recording companies)
6. Observe objects around the room and discuss the **interchangeability of parts**

INSTRUCTOR ACTIVITIES LEVEL 2

Examples:

1. Disassemble several hand planes and ask the students to reassemble the planes from piles of parts. (This activity could be done with any grouping of tools.)
2. Design and construct a model rocket (You may choose to use a commercial kit) teaching the principle of **"interchangeability of parts"** and emphasizing the technological principles of force, motion, and speed.
3. Design and construct a simple project utilizing jigs and fixtures. (Hanging windchimes, CO_2 model car, notepad holder, games, puzzles, etc.) Assign students to a line production exercise.

INSTRUCTOR ACTIVITY LEVEL 3

Design a simple project which emphasizes the concept of "interchangeability of parts" utilizing jigs and fixtures, and mass production techniques.

Examples:

Form a corporation which will manufacture and market a product. (Utilize six essentials of the manufacturing process.)

A. Research and Development

B. Production Planning

C. Quality Control

D. Personnel System

E. Manufacture

F. Marketing

COMPETENCY: 1.2 Expresses six steps in the manufacturing process

INSTRUCTOR INFORMATION:

Manufacturing process: Companies vary in the names assigned to departmental units involved in the **manufacturing process**. Regardless of what each company calls their units, their functions are similar. There will always be certain steps needed to take a product from the designer's mind to the user's hands.

The six steps involved in the **manufacturing process** are:

1. Research and Development
2. Production Planning
3. Quality Control
4. Personnel System
5. Manufacture
6. Marketing

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the concept of the **manufacturing process**:

1. Discuss examples of family, neighbors and friends that work in these various steps of the **manufacturing process**.
2. Ask the class to research family, neighbors and friends who work in the various steps of the **manufacturing process** and share with the class in an oral report, what their specific job involves.

INSTRUCTOR ACTIVITIES LEVEL 2

1. Schedule a field trip to a local industry and observe the six essentials of manufacturing in process.
2. Select a film that deals with the six essentials of manufacturing in process.

INSTRUCTOR ACTIVITIES LEVEL 3

Divide the class into six groups, one representing each element of the **manufacturing process** and have each group responsible for researching, defining and demonstrating that element for a given product to be manufactured. The product should be selected in advance with each group relating their element to the same product. The six essentials of the **manufacturing process** are as follows:

A. Research and Development

B. Production Planning

C. Quality Control

D. Personnel System

E. Manufacture

F. Marketing

COMPETENCY: 1.3 Interprets the importance of measuring tools

INSTRUCTOR INFORMATION:

Measuring tools: A number of different tools are designed for layout and measuring. Layout is measuring and marking materials to size. Examples of tools used for layout include rules, squares, dividers, and center punches. Layout is the transferring of dimensions from drawings to materials.

Some **measuring tools** commonly involved are rulers, calipers, micrometers, wire and sheet metal gauges, try square, framing square, combination square, center square, and T-bevel.

Marking tools often used with **measuring tools** in layout work are, the scratch awl, center punch, marking gauge, and dividers.

INSTRUCTOR ACTIVITIES LEVEL 1

1. Compare English and metric rulers for similarities and differences.
2. Explain basic layout and **measuring tools** and correct use to the class.
3. Display basic layout and measuring tools and demonstrate their correct use.
4. Explain examples where go and no-go gauges would help, when if they were producing a product. (Metric 500 car, rifle barrels, auto parts, machine shop projects)

INSTRUCTOR ACTIVITIES LEVEL 2

1. Demonstrate some go and no-go gauges and check a quantity of parts to see if they pass.
2. Layout different objects to the nearest 1/16 of a inch on paper, then cut it out and compare it with a pattern.
3. Demonstrate layout using a try square, framing square, combination square and a T-bevel.
4. Demonstrate how to measure diameters using both outside and inside calipers.
5. Demonstrate measurement of several parts to the nearest .001" using a micrometer.
6. Mark out several parts using a scratch awl, center punch, marking gauge and dividers.

INSTRUCTOR ACTIVITIES LEVEL 3

Develop a challenging layout and measuring exercise which requires the student to select the correct layout and measurement tools, the correct procedure for laying it out and then do so within a specific time frame. The following tools are to be used by the students:

A. Rulers

B. Calipers

C. Squares

D. Dividers

E. Center punch

F. Micrometers

G. Wire and sheet metal gauge

H. Try square

I. Framing square

J. Combination square

K. Center square

L. T-bevel

M. Templates

COMPETENCY: 1.4 Interprets the process of mass production

INSTRUCTOR INFORMATION:

Mass production: was one of the factors that contributed to the growth of manufacturing in America. With **mass production**, large quantities of parts and products could be accurately produced within a short time. **Mass production** is dependent upon interchangeable parts.

There are four principles in all **mass production** systems:

Assembly-line method--many people working together to make a product instead of one person making it in its entirety.

Interchangeable parts--where each is made to a standard size.

Labor specialization--where each person has a specific job to do.

Time and motion analysis--where studies are done to reduce any wasteful practices.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the concept of **mass production**:

1. Display and discuss in items that have been **mass produced** and ones that have not and describe why each was produced that way.

2. Display a bicycle and discuss the number of different standardized parts that went into its production. Explain the process of parts numbering and stocking for repair and replacement sales.

3. Select a simple hand tool and describe each piece that had to be interchangeable to make it possible for **mass production**.

4. Select that same tool and have students re-design some part so it could not be **mass produced** and see what product change would result. Explain cost factors for custom production compared to mass production. (Replacement of a complete item vs. replacing one part)

INSTRUCTOR ACTIVITIES LEVEL 2

1. Take a simple hand tool and re-design it so part of it could not be **mass produced**. Make that component of the tool and see how long it takes to do so. Explain principles of mass production and importance of accurate measurement in interchangeable parts.

2. Take a quantity of small objects that can easily be disassembled and reassembled. Disassemble the objects, separate the parts into common groupings and reassemble the object, keeping track of how long, on the average, it take to complete each object. On several continuous days see how much you can improve upon the time taken to assemble each object. Also, change peoples' positions within the assembly line and see how this effects the time frame of production. (Nuts & bolts, hand planes, etc.)

INSTRUCTOR ACTIVITIES LEVEL 3

Form a corporation that will mass manufacture and market a product. Be certain all six essentials of the manufacturing process are followed:

A. Research and Development

B. Personnel System

C. Production Planning

D. Manufacture

E. Quality Control

F. Marketing

COMPETENCY: 1.5 Describes the development of manufacturing

INSTRUCTOR INFORMATION:

Development of manufacturing: Modern manufacturing is very different than it was decades ago. At one time, each person or family had to make everything that they needed to live. This was time consuming, often quality materials were not available and it was not very time efficient.

Later, people began to specialize in doing only one kind of work. These work activities became known as cottage crafts because the work was usually done in the family's home or cottage.

During the late 1700's cottage crafts became less important as changes in manufacturing began to take place as follows:

1. Machines instead of hand tools were used
2. The machines were powered by engines
3. Products were produced in factories instead of homes

These changes lead to the industrial revolution.

The discovery of new materials encouraged the growth of manufacturing in America, along with mass production and interchangeable parts. The use of assembly line production, development of special tools, and improved planning also added greatly to the development of manufacturing in America. Automation and computers are bringing about changes today at an extremely fast rate.

Manufacturing has changed over time through four periods.

1. Hunting and fishing period
2. Agricultural period
3. Handicraft period
4. Industrial period

Manufacturing continues to change. It still uses the division of labor, continuous process, material movement, and interchangeable parts. However, machines are being used more, computers are making decision people used to, sensors are making quality checks, robots are doing routine factory jobs and machine centers are doing complex jobs with little supervision.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the concept of the development of manufacturing:

1. Present films on Early American crafts, working conditions and wages. Give examples of early inventions which mechanized production of goods. (Cotton gin, spinning wheel, movable type)

2. Discuss impact of robots and computers to demonstrate how manufacturing might change in the future.

INSTRUCTOR ACTIVITIES LEVEL 2

1. Describe how computers have increased speed and accuracy in modern manufacturing practices.

2. Within the lab, set-up an automated production facility for part of a product and compute the time savings.

INSTRUCTOR ACTIVITIES LEVEL 3

Set-up a production line with hand tools, and a second one for the same product with power tools. Use also jigs and fixtures to demonstrate the differences in time, in making the product.

COMPETENCY: 1.6 Illustrates why mass production is essential to our economy.

INSTRUCTOR INFORMATION:

Mass production: Our economy depends on mass production to provide enough goods for consumers, at a competitive price, both in the United States and abroad. If our economy is to continue to grow and prosper, we must design even more efficient production methods built around automation, computers and the recycling and conservation of energy.

We must keep our mass production rates high if we are going to compete with the foreign produced goods. The United States can't afford to continue with large trade deficits because we are not efficient in our production efforts. Competition necessitates continuing research and development for faster production, higher quality and lower production costs.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the concept that mass production is essential to our economy:

1. Prepare lessons about the hourly wage rate of workers in the United States with foreign countries in the same industry. (auto, electronics, garments)

2. Discuss the workers benefits in the United States and in several foreign countries. Present information about the early working conditions in American industries and the evolution of unions and their purpose and impact.

INSTRUCTOR ACTIVITIES LEVEL 2

1. Prepare lessons on the impact of manufacturing on our economy. Modern day concerns of efficient use of natural resources on the development of solar collectors, recycling aluminum, etc., should be presented. (Audio visual materials are available from some large industries).

2. Plan a field trip or bring in a guest speaker from a power plant or local industry to elaborate on current technology in the local community.

INSTRUCTOR ACTIVITIES LEVEL 3

Research the effects of mass production rates in the United States auto industry with that of Japan's auto industry and present the results in terms of:

A. Hourly wages

B. Employee benefits

C. Working conditions

D. Cost per unit

E. Average age of worker

F. Average length of time on the job

COMPETENCY: 1.7 Interprets the relationship of the economic system to the manufacturing system

INSTRUCTOR INFORMATION:

America's economic system is called capitalism--which means that the factories and all that they contain are owned by individuals or by companies. Any economic system is the way in which the essentials of industry combine to produce and distribute goods and services. With private ownership, businesses are free to produce whatever they wish. This produces a competitive market that brings improved products to the marketplace, which in turn benefits the consumer with better and less costly products.

Supply and demand play a large part in America's economic system. Take the case of the pocket calculator that started out at $100 and can now be purchased for less than $5. The price went down as the supply went up and more companies produced a better calculator. Capitalism encourages profit-making which in turn encourages people to invest in profitable businesses.

Further, in the United States our industrial system is called free enterprise. This permits a company to start almost any kind of business and make almost any kind of product it wants.

Inventors of new products are granted patents by the government to protect their ideas. Inventors can then allow others to use the patent under a licensing agreement.

In some foreign countries, the government owns the factories and businesses. There is little or no competition, and usually limited products available to the consumer.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the relationship of the economic system to the manufacturing system:

1. Explain what is involved in obtaining a patent and the importance of a patent to a person or company.

2. Prepare a lesson on the differences and advantages among the following economic systems:

   A. Capitalism

   B. Socialism

   C. Communism

3. Explain how free enterprise effects our economy.

4. Present information about 2-3 countries with different economic systems.

5. Explain why our manufacturing system has declined recently and what effect this has had on our economic system.

INSTRUCTOR ACTIVITIES LEVEL 2

1. Prepare a patent drawing for a simple hand tool.

2. Prepare a detailed lesson on the differences and advantages among the following economic systems with specific examples:

   A. Capitalism

   B. Socialism

   C. Communism

INSTRUCTOR ACTIVITIES LEVEL 3

1. Have a patent attorney visit the class and discuss the following:

   A. Forms used

   B. Time involved in securing patent

   C. Costs involved

   D. Number of patents applied for yearly

   E. Number of patents granted yearly

2. Show the class a patent drawing for a machine as per patent requirements.

CONCEPT: 2.0

KNOWLEDGE OF THE ENVIRONMENT

CONCEPT INFORMATION

To address this concept the teacher should provide activities and instruction covering the following topics.

Early inhabitants of the earth and many generations thereafter were not very concerned about the environment and did little to protect it. As people demanded more products, and more ways of manufacturing were developed; the environment began to suffer. People began to realize that what was once beautiful and plentiful was becoming ugly and sparse.

The needs of our environment have become a major concern, in some instances the damages seems irreversible. The major environment problems of the present include air pollution, water pollution, and landscape pollution from solid waste, toxic substances, radiation and noise. We are now learning that every technological act by people, produces a major effect on the environment.

The environment has given us many resources which benefit people through products, goods, and services. Career opportunities have also improved our quality of life. New procedures, machines, tools, and careers have been developed to secure the natural resources for the environment.

COMPETENCY: 2.1 Describes six natural energy sources

INSTRUCTOR INFORMATION:

Natural energy sources: Energy is the ability to do work. Natural energy must be harnessed or controlled for it to be useful to man. There are six main kinds or classes of natural energy as follows:

1. Radiant
2. Water
3. Wind
4. Wood
5. Fuels
6. Heat

The kind of energy used in each case is decided by its efficiency, cost, and how easy it is to use. Nature stores and expends a great deal of energy in many ways. We are able to use only a small fraction of nature's total storehouse of energy. To use natural energy, it must be collected, contained and controlled.

INSTRUCTOR ACTIVITY LEVEL 1

To demonstrate the concept of natural energy:

1. Describe how the various forms of natural energy impact upon what we do everyday.
2. Describe which two forms of natural energy have the greatest impact on our lives. Why?
3. Describe which two forms of natural energy have the least impact on our lives. Why?

INSTRUCTOR ACTIVITY LEVEL 2

1. Prepare demonstrations for each of the six energy forms.
2. Describe how the various forms of natural energy impact upon what we do everyday.
3. Describe which two forms of natural energy have the greatest impact on our lives. Why?
4. Describe which two forms of natural energy have the least impact on our lives. Why?

INSTRUCTOR ACTIVITY LEVEL 3

1. Prepare lessons and demonstrations that explain which two natural energy sources are the most easily renewable and why.

2. Prepare lessons and demonstrations that explain which two natural energy sources are the least renewable and why.

3. Explain and give demonstrations how wind energy can be converted into electrical energy.

4. Explain why we don't use wind energy as a major resource throughout the United States.

COMPETENCY: 2.2 Describes four natural materials used in manufacturing

INSTRUCTOR INFORMATION:

Natural materials: These resources are the building blocks found on earth. They include:

1. Metal ores
2. Trees
3. Petroleum
4. Water
5. Natural gas
6. Sand
7. Clay

These materials have been combined with other materials to improve their usefulness. As people's knowledge of tools and resources grew, they were able to expand upon the benefits of these resources.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the concept of natural manufactured materials:

1. Select from the various natural materials used in manufacturing and find examples which were applied to products that affect our daily lives related to:
   - A. School
   - B. Home
   - C. Leisure
2. Research the natural materials used in manufacturing and find out how close these materials can be located to our school in quantities suitable for manufacturing purposes.

INSTRUCTOR ACTIVITIES LEVEL 2

1. Prepare lessons and demonstrations about the classification of natural resources into those that:

   A. Are growing on the earth

   B. Are found on the earth

   C. Are found in the earth

2. Describe what natural materials were used to manufacture selected hand tools used in the class.

3. Describe the advantages in using materials that grow, and can be properly managed, in the manufacturing process.

INSTRUCTOR ACTIVITIES LEVEL 3

1. Prepare lessons related to what natural materials are available on the moon.

2. Discuss the quantity of natural materials available on the moon in quantities greater than are available on the earth.

COMPETENCY: 2.3 Discusses two synthetic materials used in manufacturing

INSTRUCTOR INFORMATION:

Synthetic materials: Materials made by people are called synthetic materials. When the Japanese cut off our supply of silk during World War II the military needed a material to replace the silk used in parachutes. A new synthetic fabric known as nylon was used because it was light weight and strong. Today there are many products once made from natural materials, that are now made from synthetic materials.

Chemical transformations have become more important in making synthetic materials. The modern plastics industry depends almost entirely on synthetic materials. Most plastics were known to chemists many years before there was a great need for them. However, as an example, synthetic rubber was developed to meet the shortage of natural rubber during World War II.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the concept of synthetic materials:

1. Identify ten synthetic materials in the classroom and describe the natural material it resembles.

2. Prepare lessons around sports and describe how synthetic materials have impacted sports contests. (Wrestling, football, baseball, basketball, track & field, etc.)

3. Show three products made from nylon and describe the improvements in quality for that product.

INSTRUCTOR ACTIVITIES LEVEL 2

1. Compare ten synthetic materials with the natural materials they resemble.

2. Demonstrate a product that is made from synthetic materials, using natural materials and describe its effect on the product's price and useability.

INSTRUCTOR ACTIVITIES LEVEL 3

1. Compare selected synthetic materials with natural materials in terms of the following:

   A. Cost

   B. Durability

   C. Availability

   D. Texture

   E. Weight

   F. Color

2. Explain some advantages of synthetics in terms of conserving natural resources.

COMPETENCY: 2.4 Describes the two classifications of plastics

INSTRUCTOR INFORMATION:

Classifications of plastics: Plastics are synthetic materials that do not occur in nature. Plastics are made from such materials as petroleum, coal, natural gas, and wood, through a chemical change process.

Plastics are either thermoplastic or thermosetting in form. Thermoplastic can be reheated and reshaped many times. Thermosetting on the otherhand cannot be reshaped due to the chemical change that cannot be reversed. Each type of plastic has its own characteristics and is chosen accordingly for its use.

The scientific name for plastic is polymers. Polymers are made by combining monomers like you would building blocks into a chain-like structure of molecules.

MOLECULAR CHAIN	MOLECULAR CROSS LINKING
Thermoplastic has a chemical structure which can be softened repeatedly.	Thermoset plastic has a molecular cross linking and does not soften with heat after being molded.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the concept of classifications of plastics the instructor might:

1. Test a piece of thermosetting plastic and a piece of thermoplastic by trying to heat and reform each piece several times.
2. Show a number of products made from plastic and explain which type was used and why. (Thermoplastic, thermoset)
3. Describe a product where one type of plastic would be preferred over the other because of the application.

INSTRUCTOR ACTIVITIES LEVEL 2

1. Apply heat to thermoplastic and explain the chemical reaction taking place.
2. Apply heat to thermoset and explain why it does not soften.
3. Describe a product where more than one type of plastic is used and explain why.

INSTRUCTOR ACTIVITIES LEVEL 3

1. Explain how plastic is generally priced (square feet, pound, etc.) and compute the cost of two or three items made entirely of plastic.

2. Take the class to visit a local supplier of plastic products and observe the variety of plastics and their uses in many applications.

COMPETENCY: 2.5 Discusses seven forms of plastics

INSTRUCTOR INFORMATION:

Forms of plastics: All plastics are either thermoplastic or thermosetting with polyester being both. Listed below is a brief review of each plastic form.

TYPE	TP/TS	FORM	KEY CHARACTERISTIC	EXAMPLES
ABS	TP	Sheets	Excellent stretching qualities	Telephones Luggage Power tools Handles
ACRYLIC	TP	Rods, Tubes, Sheets	Weather and heat resistant	Taillight lenses Name plates Fiber optics
ACETATE	TP	Sheets	Clear, glossy and slow burning	
POLYESTER	TP/TS	Liquid	Clear, used with fiber glass	
POLYETHYLENE	TP	Pellets Powder Film	Lightweight, easy to process, resists alkalis, acids and solvents	Toys Trash cans Flash lights
POLYSTYRENE (HI-IMPACT)	TP	Beads Foam Sheets	Easily processed in a variety of colors	Refrigerator liners Drinking cups Fishing lures
POLYVINYL CHLORIDE	TP	Liquid Pipe	Scratch resistant, weather resistant, tough	

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate seven forms of plastics:

Show students samples of seven (7) common plastics and prepare a display featuring their characteristics and common product usage. (There are more than the 7 shown above and you will find current information in various books.)

INSTRUCTOR ACTIVITIES LEVEL 2

1. Prepare demonstrations to compare the key characteristics of the various plastics among themselves such as:

   A. Scratch resistance

   B. Resistance to stains

   C. Weight

   D. Relative strength

   E. Resistance to heat

   F. Color options

   G. Ease of forming

INSTRUCTOR ACTIVITIES LEVEL 3

1. Prepare lab activities to compare plastics characteristics. Buff several different types of plastics on a buffing wheel and compare the results of the finish after the same amount of polishing time.

2. Drop a medium size weight on several different types of plastics, from the same height, and compare the damage done.

3. Prepare classroom/lab activities to show strengths, weaknesses, advantages, and disadvantages of various plastics. Explain chemical reactions and safety in handling plastics. Prepare laboratory experiments for students to try hands-on jobs.

COMPETENCY: 2.6 Explain four advantages of plastics over natural materials

INSTRUCTOR INFORMATION:

Advantages of plastic: Plastics can be formed and molded using heat and pressure into shapes that natural materials cannot. The various forms of plastic have many advantages over natural materials. Some of them are as follows:

Acrylics--can be easily cut, drilled, sanded and polished

Polyesters--comes in a clear liquid form and is used for embedding small objects in castings. It is also used to laminate fiber glass in molds.

Styrenes--are easily worked, used for insulating electrical wire and homes. It comes in beads, pellets, sheets, and foams.

Cellulosics--they are clear and glossy and easy to process. Often used for tool handles.

Vinyls--generally, they are tough and weather resistant. Tubing, plastisols, sheet coating are common forms of vinyls.

Ethylenes--known as the squeeze-bottle plastic.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the advantages of plastic:

1. Locate three items that you use daily that are made from plastic and assume that plastic was no longer available. Redesign the item using non-plastic materials and specify the effect on:
   A. Cost
   B. Availability
   C. Durability
   D. Weight
   E. Usefulness
   F. Attractiveness

2. Locate three items that are not made from plastic and design them, using plastic or plastic components. Then specify the effect on its:
   A. Cost
   B. Availability
   C. Durability
   D. Weight
   E. Usefulness
   F. Attractiveness

INSTRUCTOR ACTIVITIES LEVEL 2

Provide lab activities with some available plastic materials utilizing safe working conditions.

INSTRUCTOR ACTIVITIES LEVEL 3

Develop a simple project that students can make out of plastic.

COMPETENCY: 2.7 Describes three functions of a research and development department in a manufacturing company

INSTRUCTOR INFORMATION:

Research and development: There are three main functions involved in research and development, each with certain tasks to be performed.

Research--a systematic search process for the unknown facts and principles. Through research we develop and discover new knowledge that is very important to manufacturing enterprises.

Development--involves finding the most economical and practical methods of using the facts and principles found by research activities. Through development, the ideas of research become products and processes.

Product engineering--includes the activities in the final product and design work. Product engineers prepare the drawings, performance standards and describe other qualities of the product and all its parts. A close relationship also must exist with production and marketing personnel as a product is produced for the market.

INSTRUCTOR ACTIVITIES LEVEL 1

Select a simple hand tool and take students through the three main functions involved in research and development. Include as much detail in each of the three steps as possible.

INSTRUCTOR ACTIVITIES LEVEL 2

Select a simple power tool and take students through the three main functions involved in research and development. Include as much detail in each of the three steps as possible.

INSTRUCTOR ACTIVITIES LEVEL 3

Set up a research and development function and prepare a new product for your classroom that currently is not there, but is on your needs list. Set up a research and development function and take the new item through the three steps, including as much detail as possible.

COMPETENCY: 2.8 Illustrates the terms "pure research" and "applied research"

INSTRUCTOR INFORMATION:

Pure and applied research: Research is essential to all manufacturing enterprises as it serves as the source of new ideas and products.

Pure (or basic research) is conducted to find out information. Research is not designed to achieve a company's goals and no real use for the information is immediately known. The objective is to find out new knowledge. The space shuttle flights are examples of pure research.

Applied research, on the other hand, gains knowledge to solve identified problems. In the space shuttle, an example would be to develop a material that could withstand the high temperature demands of re-entry.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the concepts of pure and applied research:

1. Describe the pure and applied research function of two items that resulted from NASA'S work in space.

2. Contact local industries that have a R & D function and invite them to discuss what is involved in each phase and some of the outcomes.

INSTRUCTOR ACTIVITIES LEVEL 2

Describe the pure and applied research function of four items that resulted from NASA'S work in space.

INSTRUCTOR ACTIVITIES LEVEL 3

Show a film from NASA or a large corporation that will explain pure and applied research. Follow-up the film with discussions of the cost and importance of research to industry.

COMPETENCY: 2.9 Identifies five major manufacturing resources

INSTRUCTOR INFORMATION:

Manufacturing resources: These five resources or manufacturing inputs are needed for any product:

Natural resources (wood, metal ores, petroleum, water, natural gas, sand, and clay).

Human resources (workers)--a wide variety of people with differing talents who can all work together.

Capital (plant and equipment)--factories offices, and warehouses needed for a place to work. Along with the equipment needed to move the materials, change its form and then process the data.

Knowledge (information and skills)--often referred to as a hidden resource because it is difficult to see or measure it.

Finance (money)--a company must have the financial resources to purchase the other resources they need.

INSTRUCTOR ACTIVITIES LEVEL 1

Demonstrate and explain the five major manufacturing resources.

INSTRUCTOR ACTIVITIES LEVEL 2

Prepare lessons to explain each of the five resources essential to manufacturing.

INSTRUCTOR ACTIVITIES LEVEL 3

1. Select two types of manufacturing industries and explain the importance of resources. Depending on the industries you may compare or contrast them.

2. An additional activity could be to have the class try to rank the resources in order of importance.

CONCEPT: 3.0

MANUFACTURING IN THE FUTURE

CONCEPT INFORMATION: No one knows for sure what manufacturing will be like in the future. However, the experts predict that it will be faster, more automated, and much more complex. In addition it will likely be more efficient and able to produce better products at less cost.

Many of the latest technical and scientific developments that will likely impact future manufacturing have grown out of the space program. It is very likely that some future manufacturing will take place in outer space. Outer space has the advantages of being clean and having no gravity. Four areas seem well suited for outer-space manufacturing:

1. Making perfect spheres

2. Mixing certain liquids

3. Refining pure metals

4. Growing crystals

On earth, machines and processes are being developed that will enable us to make better use of our natural resources, with such energy devices as solar collectors and wind generators. Recycling will continue to be an important way to use our resources wisely.

COMPETENCY: 3.1 Describes three space-related products that are manufactured

INSTRUCTOR INFORMATION:

Space related products: Many products that we enjoy everyday were made possible or improved as a result of exploration in space.

Many common products that effect us daily include:

1. Small hand-held calculators
2. Many of the heat resistant finishes
3. Greatly reduced size of computers for personal use
4. Many of the stronger epoxy adhesives
5. Stronger and lighter weight fabrics
6. Processing of food

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the concept of space related products:

1. Present and discuss at least two space related products that are used daily which did not exist prior to space research.
2. Describe how the products selected in number one (above) have replaced or improved products used in the past.

INSTRUCTOR ACTIVITIES LEVEL 2

Develop plans for a simple solar cooker and have teams of two construct and demonstrate them.

INSTRUCTOR ACTIVITIES LEVEL 3

1. Brain storm with students and predict what future space-related products will be developed and how they might impact on our lives.
2. Assist students to develop simple solar units to heat water or cook food.
3. Assign a problem for groups of students to solve by designing and making a working model.

COMPETENCY: 3.2 Describes how new products are researched

INSTRUCTOR INFORMATION.

New products: The Research and Development departments have the responsibility for designing new products, improving existing products and finding new and improved ways to make the products. Usually many people are involved in shaping an idea that results in new products.

Skilled model makers construct mock-ups to help the ideas take on a three dimensional shape. Engineers become involved in making certain that products will work and can be produced. These engineers are usually in two groups:

Product designers--industrial designers who deal with appearance and function. Designers must also think about safety, ease of use, ability to be produced and cost.

Product engineers and manufacturing engineers--are the engineers who develop the means of producing the product after it has been designed.

The marketing and sales people can tell if consumers will want the new product. In addition financial backing is needed to support the research and development of the new product.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate how new products are researched:

Design a new hand tool for your class that will perform some special operation. Take it through the following steps in a planning mode:

A. Researching the idea

B. Developing the product design

C. Producing and manufacturing the item

D. Sales and marketing

INSTRUCTOR ACTIVITIES LEVEL 2

Design a new power tool for your class that will perform some special operation. Take it through the following steps in a planning mode:

A. Researching the idea

B. Developing the product design

C. Producing and manufacturing the item

D. Sales and marketing

INSTRUCTOR ACTIVITIES LEVEL 3

Design and produce a product for sale by taking it through the following steps:

A. Researching the idea

B. Developing the product design

C. Producing and manufacturing the item

D. Sales and marketing

COMPETENCY: 3.3 Explains three environmental considerations in the manufacturing process

INSTRUCTOR INFORMATION:

Environmental considerations: Needs and problems of the environment have become major concerns. In some cases, damage done to the environment is irreversible. Most advances in technology use the environment and can create an environmental problem. How society deals with environmental problems will determine future technological programs and perhaps our survival on earth.

Present environmental problems that must be considered in any manufacturing process include air pollution, water pollution, and landscape pollution from solid waste, toxic substances, radiation and noise. Many of these problems have unwanted effects on modern technology.

Technology was created to overcome needs and problems of people in our society. It is important that as people search for ways to meet their needs, and solve their problems, that they carefully consider the environmental effects in the manufacturing process.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the environmental considerations in manufacturing:

1. Study a local manufacturing industry and determine what they are doing to protect the environment in the manufacturing operation.

2. Study that same industry and project what impact would be felt on the local environment if their manufacturing process did not consider the environment.

INSTRUCTOR ACTIVITIES LEVEL 2

1. Study a local manufacturing industry and determine what they are doing to protect the environment in the manufacturing operation.

2. Study that same industry and project what impact would be felt on the local environment if their manufacturing process did not consider the environment.

INSTRUCTOR ACTIVITIES LEVEL 3

1. Check environmental standards that effect local industries and see how the company monitors themselves to make certain they are in compliance with the standards. Invite them to speak to the class.

2. Make contact with local environmental action groups to see what they do to monitor certain manufacturing industries to make certain they are in compliance with the law. Invite them to speak to the class.

COMPETENCY: 3.4 Translates the term "robotics"

INSTRUCTOR INFORMATION:

Robotics: Robots are machines that perform tasks automatically. Their use in production work is increasing, particularly in the automobile and electronics industries. They are often used to do welding, spray-painting, lifting and moving heavy parts.

A robot is basically a mechanical arm controlled by a computer. At the end of its mechanical arm is a special hand called an "end effector". The robot can be programmed to perform the same task over and over without it wanting a coffee break, to go on strike, or leave on vacation. Although robots are very expensive they are also very efficient production tools worth the extra cost.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the concept of "robotics":

1. Contact local industries in the area to find out the extent robotics is being used in their manufacturing operation.
2. Identify jobs that robots can do better than people.
3. Identify jobs that people can do better than a robot.
4. Discuss if robots will ever replace people totally in the manufacturing of goods.
5. Show a film on robotics.

INSTRUCTOR ACTIVITIES LEVEL 2

1. Contact local industries in the area to find out the extent robotics is being used in their manufacturing operation.
2. Identify jobs that robots can do better than people.
3. Identify jobs that people can do better than a robot.
4. Discuss if robots will ever replace people totally in the manufacturing of goods.

INSTRUCTOR ACTIVITIES LEVEL 3

Locate a robotics simulator and program the machine to perform basic mechanical skills to demonstrate for your class.

COMPETENCY: 3.5 Distinguishes between the terms "CAD" and "CAM"

INSTRUCTOR INFORMATION:

"CAD" and "CAM": are two terms used a great deal today in the manufacturing industry.

"CAD" which stands for Computer-Aided Design (CAD) allows the designer to design and view objects in three dimensions. It is estimated that by 1990:

1. Twenty-five per cent of all machine parts will be designed by CAD
2. Twenty-five per cent of all tooling will be designed by CAD
3. Fifty per cent of all mechanical drawings for prototype developments will be done on CAD systems

"CAM" stands for Computer-Assisted Manufacturing (CAM) which might include a number of automated factory systems such as:

FMC--Flexible Machine Center

AI--Automatic Identification

JIT--Just in Time

AGVS--Automatic Guided Vehicle System

ASRS--Automatic Storage and Retrieval System

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the concepts of "CAD" and "CAM":

Contact local industries and find out which are using "CAD" and "CAM" in their production and to what extent. Plan a visit for the class.

INSTRUCTOR ACTIVITIES LEVEL 2

Contact local industries and find out which are using "CAD" and "CAM" in their production and to what extent.

INSTRUCTOR ACTIVITIES LEVEL 3

Contact and visit an automated manufacturing company in your area that uses "CAD" or "CAM". Detail their utilization of these systems in terms of:

A. Length of time system has been in use

B. Dollar input in installing system

C. Down time experienced with the system

D. Effect on production costs

E. Effect on hourly wages

F. Effect on employee benefits

COMPETENCY: 3.6 Interprets the term "automation"

INSTRUCTOR INFORMATION:

Automation: a way of making a machine, process or system operate without constant human control. For example a thermostat serves this function for a building. Automation has become an important factor in American manufacturing. As more assembly lines are created, more and more machines are made to operate with less human control. Automation allows more work to be done around the clock with increased efficiency and lower costs. Often jobs that are simple or routine jobs are automated so workers can be assigned to more demanding jobs.

Automation has the following effect:

1. Increases production capacity
2. Reduces waste
3. Improves working conditions
4. Improves distribution
5. Reduces costs

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the concept of "automation":

1. Explain how automation effects our life in terms of:
   A. Number of products available
   B. Costs of products
   C. Quality of products available
   D. Number of jobs available
2. View a local industry that used conveyor belts for automatic handling of materials and observe:
   A. Work in production
   B. What happens when the conveyor belts are speeded up?
   C. What happens when the conveyor belts are slowed down?
   D. What happens when a worker falls behind in work on the line?

INSTRUCTOR ACTIVITIES LEVEL 2

1. Explain how automation effects our life in terms of:

   A. Number of products available

   B. Costs of products

   C. Quality of products available

   D. Number of jobs available

2. View a local industry that used conveyor belts for automatic handling of materials and observe:

   A. Work in production

   B. What happens when the conveyor belts are speeded up?

   C. What happens when the conveyor belts are slowed down?

   D. What happens when a worker falls behind in work on the line?

INSTRUCTOR ACTIVITIES LEVEL 3

Prepare to establish an automated assembly line as per Competency 1.4, Instructor Activity Level 3

COMPETENCY: 3.7 Designs a floor plan for a manufacturing plant

INSTRUCTOR INFORMATION:

Floor plan: Many time consuming factors must be taken into account in designing a floor plan for a manufacturing company. Consideration must be made for obtaining a plant, its location, and who is in charge of designing buildings for production. Will it be carried out by the company's plant engineer or by an outside engineering firm? The plant designer begins by analyzing the products to be manufactured in the new plant. They need to know the following:

Inputs--what will go into the plant

Processes--what will be done to the materials

Outputs--what products will come out

The use of templates and models are very helpful as changes can be made quickly in the planning process.

Additional items to be considered in layout of the floor plan are:

1. Obtaining the least amount of handling for materials
2. Efficient use of floor areas
3. Using the least amount of money in equipment
4. Using workers at their highest skills with the least amount of wasted time
5. Providing safe and comfortable working conditions

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the design of a floor plan for a manufacturing plant:

1. Prepare templates for the various machines in the school's laboratory to be used later in designing a floor plan for a manufacturing plant.
2. Prepare a routing schedule for the school's laboratory to be used later in designing a floor plan for a manufacturing plant.
3. Prepare a list of restriction for the school's laboratory to be used later in designing a floor plan for a manufacturing plant.

INSTRUCTOR ACTIVITIES LEVEL 2

1. Prepare templates for the various machines in the school's laboratory to be used later in designing a floor plan for a manufacturing plant.

2. Prepare a routing schedule for the school's laboratory to be used later in designing a floor plan for a manufacturing plant.

3. Prepare a list of restriction for the school's laboratory to be used later in designing a floor plan for a manufacturing plant.

INSTRUCTOR ACTIVITIES LEVEL 3

Develop a floor plan for producing a selected product using the schools' laboratory work area, using templates, a list of restrictions and a routing schedule.

COMPETENCY: 3.8 Designs five new products for future manufacturing

INSTRUCTOR INFORMATION:

New products: Before a new product is produced, it is first identified for possible future production by a sales forecast. The forecast is based on a survey taken to find out if there will be a market for the product.

If is also essential to state the design problem properly. It must be stated in terms of what will be done in clear and simple terms.

Similar steps are usually followed in designing products as follows:

1. Collecting ideas
2. Sketching ideas
   - A. Thumbnail sketches
   - B. Rough sketches
   - C. Renderings
3. Making mock-ups
   - A. Paste-up mock-ups
   - B. Appearance mock-ups
   - C. Hard mock-ups
4. Drawing plans
   - A. Detail drawings
   - B. Assembly drawings
   - C. Schematic drawings
5. Building prototypes

Sketches are cheap to make and quick to complete. The three kinds of sketches are presented to the company's management along with the designers ideas.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate new product design:

Prepare three of the following sketches of a new product that could be manufactured in the future:

A. Thumbnails

B. Roughs

Explain each process to the class as you develop the sketches.

INSTRUCTOR ACTIVITIES LEVEL 2

Prepare renderings of two products that could be manufactured in the future.

INSTRUCTOR ACTIVITIES LEVEL 3

Prepare five examples of new products that could be manufactured in the future. Provide the following sketches for each product.

A. Thumbnails

B. Roughs

C. Renderings

COMPETENCY: 3.9 **Describes three changes in communications over the past ten years.**

INSTRUCTOR INFORMATION:

Communications: The communications industry has changed dramatically over the past ten years. The industry needs manufactured products for sending and receiving messages.

Telephones and radios have made the world seem smaller. Car radios offer news and entertainment. Ship-to-shore radio's improve safety at sea. Two way radios are used to help workers communicate on construction projects, in factories and in warehouses. Even astronauts on the moon talk with people on earth by radio-telephone.

Synthetic rubies are used to produce laser beams. The use of the laser beam has not been fully realized but someday it may be used to carry thousands of messages at one time over long distances.

Communication satellites enable people to watch live events from all over the world. Fiber-optics has greatly increased the flow of information in communication. Computers and their networking capabilities has greatly effected the communication industry.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the changes in communication in the future:

1. Describe how new developments in communication have improved the school environment?

2. Describe how new developments in communication have improved the home environment?

INSTRUCTOR ACTIVITIES LEVEL 2

1. Describe how new development in communication have improved:

   A. School environment

   B. Home environment

2. Explore two changes in the future of communication that will most likely impact upon school and home environment.

INSTRUCTOR ACTIVITIES LEVEL 3

Describe in detail how the breakup of AT&T into different components has affected our lives in terms of:

A. Availability of use

B. Cost for use

C. Dependability of services

D. Buying versus renting/leasing equipment

E. Advertising

COMPETENCY: 3.10 Explains the five basic needs of humans

INSTRUCTOR INFORMATION:

Basic human needs: All human beings have basic needs as follows:

Physical needs--for food, water and rest

Security needs--for safety and organized living

Love needs--to belong, be liked, and appreciated

Esteem needs--for respect, self-respect and respect of others

Self-fulfillment needs--desire to become the best that one can be

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate basic needs:

Describe the inter-relationship of human, societal, technological and environmental needs.

INSTRUCTOR ACTIVITIES LEVEL 2

Describe the inter-relationship of human, societal, technological and environmental needs.

INSTRUCTOR ACTIVITIES LEVEL 3

1. Describe what future basic needs persons are not likely to have which they have today?

2. Describe what future needs persons are likely to have, that they do not have today?

COMPETENCY: 3.11 Prepares a four step personal career plan

INSTRUCTOR INFORMATION:

Career plan: Planning is basically a four-step process involving:

1. Gathering information
2. Arranging information
3. Considering alternatives
4. Deciding

In selecting, preparing, and entering a fulfilling career; the first step is gathering information. One needs information about:

1. Herself or himself
2. The world of work, its structure and its trends
3. Training options and career paths
4. How to get and keep a job

The second step is arranging information or putting together the information we have.

Third, consider the alternatives and the consequences and costs of each goal and course of action being considered.

Last, decide on a career goal. Often one must shift temporarily from our career goal, in favor of a secondary goal.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the four steps to career planning:

Develop a sample personal career plan with as much detail as time permits. The instructor may also be involved in helping individuals prepare their personal career plan.

INSTRUCTOR ACTIVITIES LEVEL 2

Have students develop a personal career plan with as much detail as time permits. The counseling staff should also be involved in helping individuals prepare their personal career plans and evaluating their potential.

INSTRUCTOR ACTIVITIES LEVEL 3

Administer at least one interest inventory to the class, and plan lessons to incorporate the results into the career planning process.

COMPETENCY: 3.12 Locates four occupations in the Dictionary of Occupational Titles

INSTRUCTOR INFORMATION:

Dictionary of Occupational Titles or DOT as it is often referred to, is a system of analysis and classification. The system was developed by the Department of Labor.

The Department of Labor has classified and defined over 20,000 occupational titles in this document. The classification structure identifies the individual occupations by 9-digit code numbers. The classification structure consists of three arrangements of job codes:

1. Occupational group arrangement
2. Worker trait/worker functions arrangement
3. Occupational title code number to separate and uniquely identify each occupation

The classification provides a method of grouping jobs having the same basic occupational or worker traits/ characteristics so that users can discern various relationships among occupations. This is a standard approach to classifying the abilities, vocational experiences and/or potentials of workers.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the use of the DOT:

Prepare lessons to explain the DOT and the one, two and three digit occupational categories, divisions, and groups.

INSTRUCTOR ACTIVITIES LEVEL 2

Show students how to look up three occupations that relate to manufacturing.

INSTRUCTOR ACTIVITIES LEVEL 3

Show students how to look up at least four occupations within the DOT that relate to manufacturing in a local industry.

CONCEPT 4.0

Personnel in Technology

CONCEPT INFORMATION

Industrial workers come into contact daily with personnel practices on their jobs. All workers in the field of manufacturing are hired, trained, worked, advanced and retired.

A product may be well designed and engineered, but little of this matters unless able workers can be hired to make it. Hiring practices therefore become very important. When trained workers cannot be hired, then training must be provided to give the workers the knowledge and skills they need to do the job.

Working conditions on the job have a lot to do with whether or not workers want to stay on the job. Advancement and retirement practices are important reasons that workers elect to stay with the same employer. People can be the most valuable resource a company has.

Personnel technology involves not only the production workers, but also all levels and kinds of management personnel.

COMPETENCY: 4.1 Interprets nine elements related to the "work ethic"

INSTRUCTOR INFORMATION:

Work ethic: Almost all successful people have these characteristics in common:

1. They believe in themselves, they have a "can do" attitude and a good opinion of their personal worth and waste little of their time.

2. They set goals and objectives and recognize that accomplishment is meaningless without goals. They turn their long range goals into a series of reachable short range objectives.

3. They practice self-discipline. They do what should be done when it should be done.

4. They work hard. They put in the effort by investing the physical and mental energy required to get the job done.

5. They gain new knowledge and skills. They realize that they will always need more knowledge and skills.

6. They are human relations smart. They understand other people and what motivates them.

7. They have the courage to act. They are doers and willing to take chances.

All people are different. They differ in their interest, their abilities, their personalities and their potential.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the concept of work ethic:the instructor might:

1. Evaluate your own work ethic related to the elements discussed and rate the value related to each on a scale of 1 to 5 (five being highest). For all ratings less than three, develop a plan of action to improve that element.

2. Repeat this activity but have three students rate you and average their scores, then compare any differences.

INSTRUCTOR ACTIVITIES LEVEL 2

1. Evaluate your own work ethic related to the elements discussed and rate the value related to each on a scale of 1 to 5 (five being highest). For all ratings less than three, develop a written plan of action to improve that element.

2. Repeat this activity but have five students rate you and average their scores, then compare their differences.

INSTRUCTOR ACTIVITIES LEVEL 3:

1. Explain selected standardized instruments that rate ones' abilities related to work ethic.

2. Describe how the work ethic has changed in America over the past twenty-five years.

COMPETENCY: 4.2 **Describes six responsibilities of an employee to an employer**

INSTRUCTOR INFORMATION:

If employees are to develop into a safe and successful workers, they must possess the following attitudes toward their job and employer:

Promptness--being there on time each day.

Regular attendance--every person has an important job to do each day, it often creates problems when someone else has to do their job because they did not show up.

Cooperation--the main reason most people lose their job. Listen to and work with supervisors and fellow workers.

Reliability--being trusted by the company to do a job. A willingness to accept responsibility.

Persistence--means not giving up easily. Sticking to difficult tasks to see them through.

Patience--one who does not blow-up and is difficult to work with.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the responsibilities that employees have to their employer:

1. Explain the following six factors and ask students to rate their abilities on each as they relate to working in this class:

   A. Promptness

   B. Regular attendance

   C. Cooperation

   D. Reliability

   E. Persistence

   F. Patience

2. Have someone else rate them on the six factors and compare the results

INSTRUCTOR ACTIVITIES LEVEL 2

1. Explain the following six factors and ask students to rate their abilities on each as they relate to working in this class:

   A. Promptness

   B. Regular attendance

   C. Cooperation

   D. Reliability

   E. Persistence

   F. Patience

2. Have others rate them on the six factors and compare the results, then discuss and prepare a written explanation of any differences.

INSTRUCTOR ACTIVITIES LEVEL 3

Talk with local personnel directors and find out:

A. What they expect from their employees

B. What is most important for promotion

C. What most often leads toward dismissal

D. Invite a personnel director to speak to the class.

COMPETENCY: 4.3 Describes six responsibilities of an employer to an employee

INSTRUCTOR INFORMATION:

Employees can usually expect from an employer reasonable wages in line with the training required and the job to be done, in addition to:

Hours--related to when a worker must work and how overtime is paid.

Vacation with pay--depending on the amount of time with the company and the level of the position within the company.

Retirement program--depending on the amount of time with the company and any additional contributions made by the employee.

Health insurance program--covering major medical, life and disability and perhaps some dental and eye care.

Adequate breaks--for lunch, restroom and relaxing during the working day.

Reasonable physical conditions--dealing with lighting, noise, smoke, harmful fumes.

Safe working condition--related to machines, air, chemicals.

INSTRUCTOR ACTIVITIES LEVEL 1

To illustrate the employers responsibilities to their employees:

1. Talk with the class to find out what benefits they expect receive from an employer. Rank the benefit as to the most and least important. Discuss any major differences.

2. Talk with personnel directors in local manufacturing companies to see what benefits they provide for their employees. Prepare a list to give to the students. Relate this list to 1 (above).

3. Talk with a professional recruiter for a manufacturing company to see what benefits they provide for their employees. Prepare a list to give to the students. Relate this list to 1 (above).

INSTRUCTOR ACTIVITIES LEVEL 2

Complete activities 1-3 under level 1 but prepare lesson in more detail and involve the students in discussions.

INSTRUCTOR ACTIVITIES LEVEL 3

Research how much the various benefits that companies provide employees add to the cost of labor to the industry. Prepare lesson that illustrates the real cost of labor when benefits are included.

COMPETENCY: 4.4 Identifies three major considerations in establishing a worker training program

INSTRUCTOR INFORMATION:

Training program: Even though a worker may bring to the job, basic training skills, different employers will want the job done different ways. Described below are some of the ways that companies train people:

On-the-job--which is used most by industry today. This involves one new worker for each instructor. It is very effective in teaching a selected skill but has the disadvantage of being very time consuming.

Vestibule schools--school set up by a company but not directly in the production area. Involves the cost of purchasing machines for training that are not being used in production.

Apprenticeship--is the oldest kind of training. It usually takes several years to complete such a program.

Classroom training--usually involving knowledge that is taught by an expert using media to assist with the learning process.

Cooperative Training--involves an agreement between a school and a company to prepare new workers. The program is designed so that the job fits the education and the education fits the job.

INSTRUCTOR ACTIVITIES LEVEL 1

To illustrate the various types of worker training programs:

1. Talk with companies in the area related to the various types of worker training programs available. Ask about the following types:

   A. On-the-job

   B. Vestibule

   C. Apprenticeship

   D. Classroom Training

   E. Cooperative Training

2. Prepare lesson about the local training programs.

INSTRUCTOR ACTIVITIES LEVEL 2

Complete activity 1 in level 1 preparing lesson in a more detailed format.

INSTRUCTOR ACTIVITIES LEVEL 3

Research selected companies in your area to find:

A. Amount of time they spend on worker training programs

B. Amount of money they spend on training workers

C. Has the amount of money increased or decreased for this function during the past 5 years?

D. What are their projection for training needs in the next five (5) years.

E. How do these facts relate to high school education and/or vocational educations?

COMPETENCY: 4.5 Describes eight careers in the manufacturing industry

INSTRUCTOR INFORMATION:

Careers in manufacturing: a large portion of our work force works directly in manufacturing. Many more work in jobs that are indirectly related to manufacturing.

Employment in the manufacturing industry may be divided into two main categories:

1. Durable goods employment
2. Nondurable goods employment

Durable goods are those that have a life of three years or more. Nondurable goods are those expected to last less than three years.

In durable goods manufacturing there are ten categories as follows:

1. Ordnance (Military weapons)
2. Stone-Clay-Glass
3. Lumber-Wood
4. Primary Metals
5. Furniture
6. Fabricated Metals
7. Electrical Equipment
8. Instrument
9. Transportation Equipment
10. Machinery

In nondurable goods manufacturing there are also ten categories:

1. Food
2. Printing and Publishing
3. Tobacco
4. Chemicals
5. Textile Mill
6. Petroleum
7. Apparel

8. Rubber

9. Paper

10. Leather

INSTRUCTOR ACTIVITIES LEVEL 1

To illustrate careers in the manufacturing industry:

Check with the counselors and other sources to see what manufacturing careers are expected to expand over the next 5-10 years.

INSTRUCTOR ACTIVITIES LEVEL 2

From the list of careers expected to expand, select three that are found locally or in the state.

INSTRUCTOR ACTIVITIES LEVEL 3

1. Check with the counselor and other sources to see what manufacturing careers are expected to expand over the next 5-10 years.

2. From the list of careers expected to expand, select three that are found locally or in the state.

COMPETENCY: 4.6 Explains the term "collective bargaining"

INSTRUCTOR INFORMATION:

Collective bargaining: is not an end in itself. It is a process to obtain certain rewards for the workers such as more money, security or other benefits. Collective bargaining is a compromise among the many desires that people have on both sides.

Collective bargaining is a major management labor activity designed to prepare a labor agreement or contract. In this process, both the union and management must bargain in good faith. Usually this process involves meetings where proposals and counterproposals are presented. There is a give-and-take situation until agreement is reached with both sides. If the agreements are then approved by the workers then a legal contract results. If agreement is not reached, then workers may vote to strike. When an agreement is reached, it is in force for a stated period of time.

INSTRUCTOR ACTIVITIES LEVEL 1

To illustrate the term collective bargaining:

Prepare lesson on personnel and management. Explain the purposes of labor unions.

INSTRUCTOR ACTIVITIES LEVEL 2

Prepare lesson on labor unions and set up role playing activities.

INSTRUCTOR ACTIVITIES LEVEL 3

Obtain a copy of a union contract from a manufacturing company and study the following:

A. Wage structure

B. Hiring practices

C. Firing practices

D. Insurance benefits

E. Vacation benefits

F. Working conditions described

G. Seniority

H. Severance pay

Explain each of the above to the class and provide comparisons with other types of industry.

COMPETENCY: 4.7 Explains the term "organized labor"

INSTRUCTOR INFORMATION:

Organized labor: is the joining together of workers so they can express their rights and ideas to management. As individuals they feel powerless in dealing with management.

The National Labor Relations (Wagner) Act of 1935 provides workers with a means of being heard. It guarantees the right of employees to:

1. Organize and join a union of their choice
2. Bargain collectively with their employer

Organizing a union involves several steps and may vary among companies. The six most common activities involved are:

1. Forming a plant committee
2. Developing a program to promote the union
3. Getting authorization cards signed
4. Submitting a NLRB petition
5. Holding an NLRB supervised election
6. Making the union the official bargaining agent for the workers

INSTRUCTOR ACTIVITIES LEVEL 1

To illustrate organized labor:

Contact a local union in the school district that represents workers to see what is involved in starting a local union group.

INSTRUCTOR ACTIVITIES LEVEL 2

Contact a local union in the school district that represents workers to see what is involved in starting a local union group.

INSTRUCTOR ACTIVITIES LEVEL 3

Write to the AFL-CIO headquarters in Washington, DC, to find out what is involved with starting a union as a local of the main union organization. Prepare lesson based on information received. Explain pros and cons of unions, open shop, closed shop, etc.

COMPETENCY: 4.8 Describes four examples of employee fringe benefits

INSTRUCTOR INFORMATION:

Fringe benefits: refers to all of the benefits beyond wages and hours. Such things as vacation with pay, retirement programs, health insurance programs, coffee breaks, restroom facilities, lighting and other items related to the physical environment.

Fringe benefits also include such things as extra pay for working night shifts and holidays, jury duty pay, and cost of living changes in pay.

Also included by some companies are what is referred to as "services". They are usually social, cultural, or recreational. They can include company sponsored sports programs, parties for special occasions, an annual picnic, tickets for special events and many other extras.

INSTRUCTOR ACTIVITIES LEVEL 1

To illustrate the concept of fringe benefits:

1. Contact local manufacturing companies and find out what fringe benefits the company provides related to:

   A. Paid vacation

   B. Paid sick leave

   C. Retirement plan

   D. Insurance programs

   E. Overtime pay

   F. Night shift pay

   G. Cost of living changes

2. Make a chart and compare benefits among companies studied.

INSTRUCTOR ACTIVITIES LEVEL 2

1. Contact local manufacturing companies and find out what fringe benefits the company provides related to:

   A. Paid vacation

   B. Paid sick leave

   C. Retirement plan

   D. Insurance programs

   E. Overtime pay

   F. Night shift pay

   G. Cost of living changes

2. Prepare visuals to compare the benefits among the companies:

INSTRUCTOR ACTIVITIES LEVEL 3

Find out the same information as requested in levels 1 and 2 but compare the fringe benefits between the workers involved in the manufacturing of the products and the managers of the operation.

COMPETENCY: 4.9 Develop a line-staff organizational chart for a small manufacturing business

INSTRUCTOR INFORMATION:

Line-staff organization: Line activities are those which are essential for production and sales to continue. Line activities are concerned with operations or getting the product out.

Any functions which are not line functions exist only to help the line perform its major functions well. Those helping functions are called staff functions. Staff units are helpful in different ways. Some units just give advice (not orders), some provide technical services, some have coordination responsibilities, and some control assignments. Some staff functions have authority over line personnel, while others do not.

It depends on a given situation as to the ability of a staff function to tell a line function what to do. However, it is not good practice to have a set-up where an employee has two bosses.

A small company may not have any staff functions but rather only a simple line organization.

INSTRUCTOR ACTIVITIES LEVEL 1

To illustrate a line-staff organization:

1. Contact a local manufacturing operation and secure a copy of their line-staff organization chart. Find out as much as possible about the organization chart.

2. Develop a line-staff chart of the school, ie. superintendent, principal, dean, counselors, teachers, custodians.

3. Develop a line-staff chart of the student government at the school.

INSTRUCTOR ACTIVITIES LEVEL 2

1. Contact a local manufacturing operation and secure a copy of their line-staff organization chart. Find out as much as possible about the organization chart.

2. Develop a line-staff chart of the school, ie. superintendent, principal, dean, counselors, teachers, custodians.

3. Develop a line-staff chart of the student government at the school.

INSTRUCTOR ACTIVITIES LEVEL 3

1. Develop a line-staff operation chart for a company which could manufacture products that were researched and developed in previous competencies. Include as much detail as possible in the chart.

2. Develop a line-staff chart of the school, ie. superintendent, principal, dean, counselors, teachers, custodians.

3. Develop a line-staff chart of the student government at the school.

COMPETENCY: 4.10 Explains an "open shop"

INSTRUCTOR INFORMATION:

Open shop: is one where workers do not have to belong to a union to work in the operation.

INSTRUCTOR ACTIVITIES LEVEL 1

To illustrate the concept of an open shop:

Explain the term with examples.

INSTRUCTOR ACTIVITIES LEVEL 2

Explain the term and involve students in discussions.

INSTRUCTOR ACTIVITIES LEVEL 3

Explain the term and discuss advantages/disadvantages.

COMPETENCY: 4.11 Explains a "closed shop"

INSTRUCTOR INFORMATION:

Closed shop: is one where workers must be a member of the union to work in the operation.

INSTRUCTOR ACTIVITIES LEVEL 1

To illustrate the concept of a closed shop:

Explain the term and give examples.

INSTRUCTOR ACTIVITIES LEVEL 2

Explain the term and have class discussion.

INSTRUCTOR ACTIVITIES LEVEL 3

Explain the term and relate it to "open shop".

COMPETENCY: 4.12 Describes three examples of technological advances in the manufacturing process in the past ten years.

INSTRUCTOR INFORMATION:

Advances in the manufacturing process over the past ten years have greatly changed manufacturing. These changes have taken place at an extremely fast rate due to the research being done in the field of manufacturing.

Three major factors that have brought about these advances are:

Automation--the operating of a machine, process or system without constant human control of the process. Automation has become an important factor in the manufacturing operation in America. Many new manufacturing operations are being planned to be completely automated.

Computers--have made manufacturing of today more efficient. They can keep records or store information, write orders or make decisions, and calculate costs and project future needs. The computer is able to slow down, speed up, or tell the operator when the tool needs to be changed. Computers will continue to be a large part of the future of the manufacturing process.

Recycling and Energy Conservation--has become a major technological advancement. As materials are recycled or processed again, energy and natural resources are saved.

INSTRUCTOR ACTIVITIES LEVEL 1

To illustrate technological advances:

Select one major technological advancement in the manufacturing process of the past ten years and explain its impact on several companies in the local area.

INSTRUCTOR ACTIVITIES LEVEL 2

Select one major technological advancement in the manufacturing process of the past ten years and study its impact on several companies in the local area. Discuss USA and Japan partnerships (joint ventures) in the auto industry.

INSTRUCTOR ACTIVITIES LEVEL 3

Select three major technological advancements in the manufacturing process of the past ten years and study their impact on several companies in the local area. Discuss USA and Japan partnerships (joint ventures) in the auto industry. Are there other examples? What are the advantages? What are the disadvantages?

COMPETENCY: 4.13 Explains the "right to work" law

INSTRUCTOR INFORMATION:

Right to work: laws have been enacted in some states so unions could not control manufacturing operations in the state. If a company did not want to hire union workers, they would have the option of not doing so.

INSTRUCTOR ACTIVITIES LEVEL 1

To illustrate the right to work concept:

Find out if your state is a right-to-work state. Discuss advantages, disadvantages, impact on workers, employers, and production.

INSTRUCTOR ACTIVITIES LEVEL 2

Find out if your state is a right-to-work state. Discuss advantages, disadvantages, impact on workers, employers, and production.

INSTRUCTOR ACTIVITIES LEVEL 3

Compare two states with the right-to-work law and two states without the law, to see what impact the legislation has made on manufacturing operations within those states. Prepare lesson to reinforce the concept for students.

COMPETENCY: 4.14 Develops a brief personal work resume

INSTRUCTOR INFORMATION:

Personal work resume: is a brief description that outlines the kind of work experience an individual has had. It should be brief including a listing positions held, (part-time and full-time) description of responsibilities, dates employed and any other information that would help someone understand your employment history (one or two pages).

Resumes are very important in making the initial contact that will cause employers to want to talk with you further about employment opportunities with their companies.

INSTRUCTOR ACTIVITIES LEVEL 1

To illustrate the importance of a resume:

Develop a brief sample resume outlining the work experience of a person. Be certain it includes the following items:

A. Personal data

B. List of positions held

C. Description of work performed

D. Length of time in each position

E. Technical preparation completed

INSTRUCTOR ACTIVITIES LEVEL 2

Develop a brief sample resume outlining a person's work experience. Be certain it includes the following items:

A. Personal data

B. List of positions held

C. Description of work performed

D. Length of time in each position

E. Technical preparation completed

INSTRUCTOR ACTIVITIES LEVEL 3

Display and discuss several resume sample formats and obtain information from the counselor on writing resumes. Then prepare a sample personal resume of no more than two pages to include:

A. Personal data

B. List of positions held

C. Description of work performed

D. Length of time in each position

E. Technical preparation completed

CONCEPT: 5.0

INDUSTRIAL ARTS STUDENT ASSOCIATIONS

CONCEPT INFORMATION: Participation in a student association affords the individual the opportunity to develop communication, leadership, and interpersonal skills. Through individual and group efforts, students learn to plan, organize, and execute educationally oriented activities and projects.

AIASA

The American Industrial Arts Student Association (AIASA) is a national organization designed for elementary, junior high, and senior high school students who are presently enrolled in, or have completed industrial arts courses. AIASA is recognized by the United States Office of Education, the American Vocational Association, and the International Technology Education Association as the only national student organization devoted exclusively to the needs of industrial arts technology education students.

COMPETENCY: 5.1 Comprehends the use of Robert's Rules of Order

INSTRUCTOR INFORMATION:

Consider that the average person is born, reared, schooled, employed, and retired through organizational structures. The average person worships, is insured, socializes, and purchases belongings through an organization. A large percentage of learning, planning and implementation of ideas for an organization occur in meetings. Poorly conducted meetings result in a lack of involvement, productivity and satisfaction. Robert's Rules of Order provide the traditional and elementary rules of conducting an orderly meeting.

Essentially, Robert's Rules of Order is a reference book for parliamentary procedures. "Its primary purpose is to provide a set of rules for adoption by corporations, city councils, societies, clubs and occasional meetings." (Robert, 1951: 305).

Additional instruction materials concerning the basics of parliamentary procedure can be found in the publication:

Arizona AIASA Lesson Plans and Instructional Units For Leadership Contests

The primary purposes of parliamentary procedure are:

1. To enable a membership of an organization to transact business with both speed and efficiency.

2. To protect the rights of individuals.

3. To preserve harmony within the membership.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the use of Robert's Rules of Order:

Bring in a copy of Robert's Rules of Order and explain the purpose of parliamentary procedure in a meeting environment. Select several class members to play officers in an organization, and conduct a meeting with the instructor as parliamentarian.

INSTRUCTOR ACTIVITIES LEVEL 2

Review the basic rules of parliamentary procedure and assign all class members a position within an organization. Explain the basic terminology, the responsibility of each officer, and how to make a motion of business during the meeting. Conduct a business meeting during class with the instructor as the parliamentarian.

INSTRUCTOR ACTIVITIES LEVEL 3

1. Conduct a review of Robert's Rules of Order and the history of parliamentary procedure. Assign all class members a position of authority within an organization and review the levels of authority or responsibility. Conduct an organizational meeting during class with a student parliamentarian using the following meeting procedures:

   A. Call to Order

   B. Hear the Minutes of the Previous Meeting

   C. Hear Reports of Officers or Standing Committees

   D. Hear Reports of Special Committees

   E. Hear Announcements

   F. Unfinished Business

   G. New Business

   H. Adjournment of the Meeting

2. The instructor will make an evaluation at the conclusion of the meeting.

REFERENCES:

Robert, Henry M. Robert's Rules of Order Revised. Scott, Foresman and Company, Chicago, IL., 1951.

COMPETENCY: 5.2 **Demonstrates** the ability to arrange for speakers or plant visitations in the field of manufacturing.

INSTRUCTOR INFORMATION:

Public relations is a critical factor in the success of any organization or association. The ability to establish contacts in the business world, or to develop communication skills, can be improved with practice.

The use of speakers from industry, as well as plant visitations, add another dimension to the educational process. Key individuals in the manufacturing industry can often stimulate student interest and answer questions specific to the workplace. The use of field trips in industry will expose students to the innovative technology that currently does not exist in educational institutions.

This competency will not only introduce the private sector (industry) to the public sector (education), but it will conversely introduce education to industry. In addition this activity will establish a data base of contacts for future student employment.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the ability to arrange for speakers or plant visitations in the field of manufacturing:

Bring in a listing or local telephone directory and explain how to establish a data base or list of manufacturing firms from the local community. The instructor would assist the class in writing a letter to request a plant visitation or an invitation to an individual for a guest speaking engagement. This activity could be repeated for several of the local firms.

INSTRUCTOR ACTIVITIES LEVEL 2

Utilize the library to locate a listing of ten local manufacturing firms or individuals that would be willing to host a school visitation or act as guest speakers. After instruction on business letter writing, students will compose letters of request to these firms or individuals. The instructor will be responsible for editing these compositions. Students will be responsible for confirming and finalizing all details regarding plant visitations or guest speakers. This confirmation may be achieved by telephone.

INSTRUCTOR ACTIVITIES LEVEL 3

Locate information (library/ telephone directory) sufficient to secure three plant visitations or guest speakers from the local community. Prior to contacting the manufacturing firms or individuals, have students determine the various topics of interest in relation to class curriculum. Students will utilize both written and telephone correspondence to secure guest speakers and/or plant visitations. The instructor should provide information regarding local industry advisory boards.

COMPETENCY: 5.3 **Demonstrates the ability to conduct descriptive career research in industry, using a survey by mail, or a questionnaire during an interview.**

INSTRUCTOR INFORMATION:

Career information is a critical component to an industrial arts curriculum. Information about careers can often become dated as new technology is developed in the manufacturing industry. Some of the simple and basic techniques used in descriptive research can be utilized to obtain current career information.

One technique commonly used in descriptive research is a mail survey instrument, which can obtain information from a large number of respondents inexpensively. The advantage of a survey instrument is that the researcher does not have to meet with every member of the population, or sample, and each topic of research is addressed by design, prior to mailing. Another technique used to gather data is the interview process. The interview process requires more experience and a bias or personal preference can be included in the results. The use of a questionnaire designed prior to the interview will assist in gathering all the information. The instructor should include all aspects of the manufacturing and allied industries, such as job descriptions, starting wages, benefits, and potential for advancement in the profession. Another topic of research would be potential scholarships (local and national) in the manufacturing industry, and professional organizations.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the ability to conduct descriptive career research in industry, using a survey by mail, or a questionnaire during an interview:

Develop a survey instrument with the class that can be mailed to local members of the manufacturing industry. The survey instrument should be typed and designed for ease of completion. The instrument should access information about career positions, job descriptions and responsibilities, starting salaries, benefits, and potential for promotion or career advancement. The class will determine the mailing list and techniques for recording the data which is returned.

Develop a questionnaire with the class that would be used in an interview process to collect career information. Demonstrate proper techniques for interviewing and set up mock interviews with students.

INSTRUCTOR ACTIVITIES LEVEL 2

Plan instructional activities to develop both a survey instrument and interview questionnaire to collect data about careers in the manufacturing industry. Students will use the library and local telephone directory as references, and the teacher as a resource consultant. The class will evaluate the individual survey instruments and interview questionnaires with the guidance of an instructor, to select the best or a combination of the best. The selected surveys and questionnaires would be used to collect career information for the class. The survey instrument would be mailed by the class. Each student would use the questionnaire to conduct one interview with a local leader in the manufacturing industry. The instructor will facilitate in the collection and summary of career data.

INSTRUCTOR ACTIVITIES LEVEL 3

After planned instructional activities, each student will develop a survey instrument that could be mailed to local and national leaders in the manufacturing industry. The survey instrument will collect data relevant to career positions, job descriptions, starting salaries, benefits, education requirements, and career advancements. The student will mail ten survey instruments and cover letters to selected individuals on a master mailing list developed by the entire class. In addition, each student will use a questionnaire developed by the class to interview two local members of the manufacturing industry. The instructor will assist the class in data collection and summary of the career information.

COMPETENCY: 5.4 **Demonstrates the ability to organize and manage a profitable enterprise that produces a product or renders a service of educational value.**

INSTRUCTOR INFORMATION:

The proper organization and managerial leadership is critical to the success of any business venture or manufacturing firm. No single personality trait or patterns of traits can determine successful leadership. Limited research suggests that leadership abilities are cultivated through different family environments and educational experiences. Basic leadership skills can be learned or improved through a combination of instruction and practice.

The key to leadership lies in an individuals ability to predict outcomes. Several dimensions of successful leadership include:

1. Leadership will be enhanced when a leader is aware of his/her strengths and stresses or uses them.

2. Leadership will be more effective when the style employed is consistent with the nature and expectations of the group to be led.

3. A leader needs to see the possibility of leadership coming from any member of a group.

In addition to successful leadership, a business enterprise or organization needs to establish and assign different positions of responsibility. Basic recordkeeping and bookkeeping are common and important functions within an organization. The organizational structure can represent a pyramidal structure or a matrix structure. The pyramidal structure is a common approach with a single individual in charge (top management), several individuals representing mid-management responsibilities and many individuals assigned to production responsibilities. The matrix approach is typical in organizations where equal ownership of responsibilities is assumed.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the ability to organize and manage a profitable enterprise that produces a product or renders a service:

Establish an organization involving all class members that produces a common product or renders a common service. Elect or appoint classmembers to a range of leadership/management positions. Handout prepared job descriptions that explain responsibilities within the mock organization. Select or assign a simple product or service to be rendered by this new organization. The instructor will facilitate in identifying potential or real problems of this organization. Assign a system of wages for the organization along with overhead and material costs. The class, with the assistance of the instructor will determine the retail cost of the product or service.

INSTRUCTOR ACTIVITIES LEVEL 2

Establish an organization involving all class members that produces a common product or renders a common service that is marketable in the school or community. Elect or appoint class members to the different leadership/management positions required in this organization. Students will research the different positions and write the job descriptions/responsibilities. The class will determine overhead expenses and material expenses to establish the retail cost of the product or service sold. The instructor will act as a facilitator/consultant to the organization to insure the quality of the final product. Students will be assigned the responsibility to promote and market the product or service rendered.

INSTRUCTOR ACTIVITIES LEVEL 3

Establish an organization involving all class members that produces a common product or renders a common service which is marketable in the school or community. Elect or appoint class members to the different leadership/management positions required in this organization. Students will research the different positions and write the job descriptions/responsibilities. The class will determine overhead expenses and material expenses to establish the retail cost of the product or service sold. The instructor will rotate students on a weekly basis to the different positions within the organization. The instructor will act as a facilitator/consultant to the organization to insure the quality of the final product. Students will be assigned the responsibility to promote and market the product or service rendered. Upon completion of the activity, the instructor will summarize the financial success of the organization.

COMPETENCY: 5.5 **Demonstrates the ability to plan, organize and execute an activity or project that benefits the school and/or community.**

INSTRUCTOR INFORMATION:

Project design involves organizational skills that conform to structured time lines and prescribed quality standards at the point of execution. This activity will address flow charts, time lines, organizational theory, and quality standards. A discussion of market analysis could be conducted with respect to the needs of the school and/or local community.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the ability to plan, organize and execute an activity or project that benefits the school and/or community:

Conduct a general class discussion about project design involving flow charts, time lines, organizational theory, and quality standards. Select a project based on the needs of the school and/or local community. Work as a class to develop a project proposal to include a definition of the project, need for the project, time lines, production flow charts, and the standard of quality assigned to the product or service. Complete the project as a class activity, with a final evaluation given by the instructor.

INSTRUCTOR ACTIVITIES LEVEL 2

Conduct a class discussion about project design involving flow charts, time lines, organizational theory, and quality standards. Assign students to work in groups of two for the completion of this assignment. Each student group will select a project that benefits the school and/or local community. The student group will write a project proposal to include a definition of the project, need for the project, time lines, production flow charts, and the standard of quality assigned to the product or service. After approval of the instructor, the student group will complete the project and provide a written evaluation of the activity.

INSTRUCTOR ACTIVITIES LEVEL 3

Conduct a class discussion about project design involving flow charts, time lines, organizational theory, and quality standards. Each student will select a project that benefits the school and/or local community. The student will write a project proposal to include a definition of the project, need for the project, time lines, production flow charts, and the standard of quality assigned to the product or service. After approval of the instructor, the student will complete the project and provide a written evaluation of the activity.

COMPETENCY: 5.6 **Demonstrates the ability to communicate with a community organization to determine need for a product or service.**

INSTRUCTOR INFORMATION:

An increase in understanding is a requirement of more effective participation, and is a product of successful communication. Communication skills enhance individual ability to be involved with other individuals or with groups. Public relations and marketing in either the private or public sector require skill in communication.

This competency is designed to develop students skills in interpersonal relations while at the same time providing a service to a community based organization.

INSTRUCTOR ACTIVITIES LEVEL 1

Community organizations exist to help communities. Teach your students to organize a guest lecture for several classes in a two week span of time. As a special "nice touch", create a gift or certificate for the special guests to show appreciation and to serve as a reminder of the industrial education program.

INSTRUCTOR ACTIVITIES LEVEL 2

Assign groups of students the responsibility of identifying a service organization that they wish to work with as a "help project". Have them contact the president of the organization, and volunteer a Saturday of donated "slave labor". The donation of labor to the organization is in recognition of all the good things that the organization has done in the community.

INSTRUCTOR ACTIVITIES LEVEL 3

Assign the groups a community based organization to research. Teach them to:

A. Identify the organizations major purpose.

B. Identify ways that this group can assist the organization. The group that does the most significant thing to help the organization is recognized by the instructor and their names are added to the Stars of Industrial Arts Plaque in the hall. Other positive methods of reinforcement could include a letter to the parents by the principal.

C. Hold an Industrial Arts cookout and invite CBO officers to discuss their programs with students and visa versa.

COMPETENCY: 5.7 **Demonstrates the ability to participate in a competitive event to learn industrial arts and earn recognition for achievements.**

INSTRUCTOR INFORMATION:

Competition can give an added incentive to the learning process. A competitive arena provides the student with predetermined levels of recognition. Quality of craftsmanship can be taught in projects that are rewarded or displayed to a peer group.

INSTRUCTOR ACTIVITIES LEVEL 1

In cooperation with your local Cub Scouts of America or Boy Scouts of America Chapters, design and finish a pinewood derby car that could be raced in the lunchroom or some other public facility (recruitment purposes for the Industrial Arts program). Arizona AIASA has a Metric 500 car competition which would accomplish the same purpose, and has established rules and guidelines.

Emphasize the following principles of technology:

1. Friction
2. Areodynamics
3. Design processes

Note: Encourage students to sketch their ideas and then build a styrofoam prototype first, this should only take a couple of class periods.

Awards should be given for the fastest car and best looking car. Display cars in the schools primary trophy case for all students to view.

INSTRUCTOR ACTIVITIES LEVEL 2

In the AIASA list of competitive events find the Metric 500 car competition. Follow those directions and rules. Emphasize the following principles of technology:

A. Friction
B. Thrust
C. Design processes
D. Areodynamics
E. Physics - motion, mass, speed
F. CO2 cartridge principles

INSTRUCTOR ACTIVITIES LEVEL 3

Order and have students purchase identical rocket kits. Students are asked to modify their rockets so that:

A. They fly higher

B. They look better than other students

A public unveiling should be made. Official launching should also be done that day in some public manner (this would be a good public relations time to have 8th graders involved as observers). Technology principles emphasized include:

A. Chemistry (burning fuel cell)

B. Thrust

C. Weight as a design consideration

D. Mathematical techniques used for measuring height

E. Launch angle (wind considerations)

F. Design principles

G. Safety

As the instructor, a safe set-up is critical. Over protect your students. The fuel system gets extremely hot, follow all safety considerations.

COMPETENCY: 5.8 **Demonstrates the ability to organize an open house with project exhibits and a manufacturing demonstration.**

INSTRUCTOR INFORMATION:

It is essential that student work be displayed as a positive reinforcement and a method of recruiting.

INSTRUCTOR ACTIVITIES LEVEL 1 - 2 - 3

At an appropriate time during the year, organize the students into an "open house committee". During the open house, have them provide several manufacturing demonstrations. In addition, have the advanced students design and develop an industrial arts display. This display should reflect work done in the industrial arts classes. Each project displayed should emphasize the industrial arts principles as well as the technology principles covered in the curriculum.

CONCEPT 6.0

MANUFACTURING IN TECHNOLOGY

CONCEPT INFORMATION

The word technology comes from the Greek word meaning skill in doing something. The word ending in "logy" means "a science of". Science is knowledge which has an order or a system. Therefore, technology is the science of expert doing or skillful action.

Man has many technologies. Manufacturing technology is the science of making material goods skillfully.

There are three kinds of manufacturing technologies:

1. Management technology--the science of planning, organizing and controlling work.

2. Production technology--the science of preprocessing, processing and postprocessing.

3. Personnel technology--the science of hiring, training, working, advancing and retiring.

COMPETENCY: 6.1 Describes four natural resources and explain how each is obtained

INSTRUCTOR INFORMATION:

Natural resources: are the raw materials which are changed into finished products. These resources are referred to as the building blocks found on earth. They include:

1. Metal ore
2. Trees
3. Petroleum
4. Water
5. Natural gas
6. Sand
7. Clay

These resources are obtained and used in various ways. For example, energy devices like solar collectors and wind generators will be used to provide more and more heat and power. This will in turn free-up valuable petroleum and natural gas as raw materials for other products, and not limit them as fuel.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the concept of natural resources:

1. Identify four natural resources that effect our lives each day and explain how each is obtained, captured, or harnessed from their natural state.
2. Find out what natural resources are obtained in your local area and make plans to have the class observe the process used to obtain them.

INSTRUCTOR ACTIVITIES LEVEL 2

1. Identify five natural resources that effect our lives each day and explain how each is obtained, captured, or harnessed from their natural state.
2. Find out what natural resources are obtained in your local area and make plans to observe the process used to obtain them by the manufacturing company.

INSTRUCTOR ACTIVITIES LEVEL 3

Identify six natural resources that effect our lives each day and explain how each is obtained, captured, or harnessed from their natural state.

COMPETENCY: 6.2 **Explains the process of converting natural resources to standard industrial stock**

INSTRUCTOR INFORMATION:

As raw materials arrive at a manufacturing plant, they must be converted to standard industrial stock. Standard stock refers to materials that have been changed to a particular grade, size and shape, with each type of material having its own standards.

Common examples include:

1. Trees into lumber and plywood
2. Natural gas into polyethylene
3. Bauxite into aluminum sheets

The standard industrial stock becomes the "raw" material of other manufacturers. Standard industrial stock is made by a few large manufacturers, as the capital investment is very high due to the large and very special nature of the equipment needed.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate standard industrial stock:

Plan a field trip to visit a local supply house or lumber yard and locate five standard industrial stock items that were converted from natural resources.

INSTRUCTOR ACTIVITIES LEVEL 2

Plan a field trip to visit a local supply house or lumber yard and locate eight standard industrial stock items that were converted from natural resources.

INSTRUCTOR ACTIVITIES LEVEL 3

Secure a tree suitable for making standard industrial stock and outline the steps needed to make it a standard industrial stock. Then process it accordingly to meet the standards you set for the material.

COMPETENCY: 6.3 **Explains the process of converting recycled resources into standard industrial stock**

INSTRUCTOR INFORMATION:

Recycled resources: one way that many manufacturers are helping to cut down on the amount of waste and pollution to our environment resulting from manufacturing.

Recycled resources, which means; processing again, is used to produce many types of standard industrial stock. For example, empty aluminum cans are melted and made into new cans, also energy is saved, less aluminum ore is needed, less litter results, and less space is needed for dumping waste materials.

The recycling of resources also provides jobs and income for many people in preparing the standard industrial stock.

Old car bodies, glass, paper and cloth are products that are often recycled into new useful products.

The earth itself recycles materials. Trees and animals die, then they decay and after thousands of years and increased temperature and pressure they change into deposits of coal and oil. Recycling is the last phase in the cycle of manufacturing with materials.

INSTRUCTOR ACTIVITIES LEVEL 1

To illustrate the converting of recycled resources:

1. Contact a local recycling center and find out the following:

   A. How long they have been in business?

   B. What material(s) they recycle?

   C. How much they recycle?

   D. Where they get the materials to recycle?

   E. Who buys their recycled materials?

   F. What is the savings to consumers as a result?

   G. Do they see their business increasing or decreasing in the future?

2. Prepare lesson about recycling for the class.

INSTRUCTOR ACTIVITIES LEVEL 2

Contact a local recycling center and find out the following:

A. How long they have been in business?

B. What material(s) they recycle?

C. How much they recycle?

D. Where they get the materials to recycle?

E. Who buys their recycled materials?

F. What is the savings to consumers as a result?

G. Do they see their business increasing or decreasing in the future?

INSTRUCTOR ACTIVITIES LEVEL 3

Conduct a research project on the number of aluminum cans and glass that are recycled each year to determine:

A. Amount of each recycled?

B. Number of recycling plants?

C. Savings in natural resources that results?

D. Savings in costs to consumers?

E. Number of jobs created as a result?

F. Outlook for future?

COMPETENCY: 6.4 **Discusses four occupations related to standard stock production**

INSTRUCTOR INFORMATION:

Standard stock is a material that has been changed so it has certain characteristics. Each type of standard stock has its own standards in terms of grade, size and shape.

Some of the major types of standard stock are:

1. Forest products include both hardwood lumber standards and softwood lumber standards. Hardwoods are cut to standard thickness and random widths and lengths. Softwood, however, is generally produced to standard sizes in all three dimensions.

2. Metal stock is basically specified by its cross-section and its length.

3. Plastic stock is generally produced in pellets and powders or as sheets and film.

INSTRUCTOR ACTIVITIES LEVEL 1

To illustrate standard stock:

Prepare lesson on one manufacturing company that includes:

A. Kinds of stock(s) produced locally or in the state?

B. What raw materials are used by local manufacture?

C. Where the raw materials are obtained?

D. If any materials are recycled?

E. Current employment opportunities in the field?

F. Future employment opportunities in the field?

For level one this information should be brief and simple.

INSTRUCTOR ACTIVITIES LEVEL 2

Prepare lesson on standard stock and show examples of wood, metal and plastic. Discuss at least four occupations involved in each of the three types of standard stock.

INSTRUCTOR ACTIVITIES LEVEL 3

Prepare lesson and class activities to demonstrate the importance of standard stock to industry and consumers.

COMPETENCY: 6.5 Defines automation related to manufacturing

INSTRUCTOR INFORMATION:

Automation: is a way of making a machine, process or system operate without constant human control. Automated processes depend on at least one of the following principles:

Feedback--the output of a process or machine is measured and this measurement is used to regulate the machine. A thermostat is an example.

Mechanical handling--the use of conveyors and other mechanical transfer devices to transport materials between production stations. A conveyor belt and an escalator are examples.

Programmed control--a machine has been programmed and set to perform certain operations. A hot-drink dispensing machine is an example.

Data processing--a sequence of operations performed on data or information. Computers process feedback information for some kinds of automated control.

INSTRUCTOR ACTIVITIES LEVEL 1

To illustrate automation:

Identify three products that rely heavily on automated production. Classify which of the four types of automation are used and explain.

A. Feedback

B. Mechanical handling

C. Programmed control

D. Data processing

INSTRUCTOR ACTIVITIES LEVEL 2

Identify five products that rely heavily on automated production. Classify which of the four types of automation are used and explain.

A. Feedback

B. Mechanical handling

C. Programmed control

D. Data processing

INSTRUCTOR ACTIVITIES LEVEL 3

Plan a class visit to an automated production factory and classify the various types of automation going on. Results should be reviewed and illustrated where possible. Plan follow-up activities to involve students in discussion of modern technology and processes.

COMPETENCY: 6.6 Describes the process of "tooling-up" for production

INSTRUCTOR INFORMATION:

Tooling up includes several steps:

1. Deciding which existing machines, tools and equipment will be needed.

2. Selecting all standard machine tools and equipment

3. Designing and ordering machines, tools, and equipment that must be specially made.

4. Supervising the installation of machines and equipment, the start-up, and the trial run of production.

For a new plant, or a plant tooling up for a new product, large machines and heavy equipment are needed. In addition, there are dozens of small tooling items.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the concept of tooling-up:

Contact a local manufacturing industry that is or has been involved in tooling-up for production. Find out as much as you can about:

A. The amount of time involved?

B. The number of people involved?

C. The financial resources needed?

D. The material resources needed?

E. How long the operation will operate?

INSTRUCTOR ACTIVITIES LEVEL 2

Have students contact a local manufacturing industry that is involved in tooling-up for production. Find out as much as you can about:

A. The amount of time involved?

B. The number of people involved?

C. The financial resources needed?

D. The material resources needed?

E. How long the operation will operate ?

INSTRUCTOR ACTIVITIES LEVEL 3

Plan a class visit to a local manufacturing industry and observe as many of the tooling-up processes as possible. Talk with as many people as possible about their part in the operation. Prepare a written report highlighting the information.

Several competencies and concepts can and should be emphasized in one field trip.

COMPETENCY: 6.7 Identifies four engineering jobs related to "tooling-up"

INSTRUCTOR INFORMATION:

Tooling up: means getting specific tools and equipment ready for the production process.

Tooling up is an engineering job. The group in charge will vary among companies in terms of the amount of time and number of people involved.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate jobs related to tooling-up:

Prepare lecture and visual materials to explain at least three departments involved in the "tooling-up" and "re-tooling" process:

A. Product Engineering Department

B. Manufacturing Engineering Department

C. Plant Engineering Department

INSTRUCTOR ACTIVITIES LEVEL 2

Prepare lecture and visual materials to explain the responsibilities of various engineering departments in a major manufacturing industry (automobiles, airplanes, boats). Discuss the necessity for job specialization in relation to "tooling-up" or "re-tooling".

INSTRUCTOR ACTIVITIES LEVEL 3

1. Select a simple product that can be produced in your facility and have students make the necessary decisions typical of a manufacturing engineering department in tooling-up related to:

   A. Preparation of basic jigs and fixtures

   B. Procurement of materials and equipment

   C. Installation of equipment and jigs and fixtures

2. Set-up for production and have the students assume roles related to product engineering, manufacturing engineering and plant engineering.

COMPETENCY: 6.8 Defines "jigs" and "fixtures"

INSTRUCTOR INFORMATION:

Jigs and fixtures: are used to adapt machines and tools to do specific jobs. A jig is used to guide the tool and it may also be used to hold the tool in some way. The jig assures that when the operation is repeated it will be done the same way each time. Fixtures are used to hold materials in place while work is being done. Many fixtures use some type of clamping device that keeps the material from slipping or moving while it is being processed. Jigs and fixtures must be durable and easy to operate, therefore must be carefully designed.

INSTRUCTOR ACTIVITIES LEVEL 1

To illustrate the terms "jigs" and "fixtures":

Set up a demonstration of a simple jig and a simple fixture and explain the purpose of each. Allow each student to operate the machines after the demonstration.

INSTRUCTOR ACTIVITIES LEVEL 2

Demonstrate and explain the purposes of jigs and fixtures. Discuss examples and have students improve on the basic design to increase efficiency.

INSTRUCTOR ACTIVITIES LEVEL 3

After instruction and demonstration, set up a small production process that will utilize at least two jigs and two fixtures. Students should design the jigs and fixtures needed to produce the product in the shop/laboratory. Care should be taken to build in the factors important in making jigs and fixtures effective.

COMPETENCY: 6.9 Describes a mechanical fastening process

INSTRUCTOR INFORMATION:

Mechanical fastening: used to hold many parts together. Some are held permanently while other can be disassembled. Any part that may need to be replaced is put together with threaded fasteners, such as bolts and screws.

Some mechanical fasteners do not have threads, such as nails, staples, and rivets. These mechanical fasteners are used to combine parts permanently. There are also non-threaded fasteners such as cotter pins, retainer rings and clips, that are used when an assembly may need to be taken apart.

Fasteners are divided into groups as follows:

Permanent--rivets

Semi-permanent--threaded fasteners and wood screws, machine screws, bolts and wire fasteners

Temporary--wing nuts, quick snap clips, and cotter pins

INSTRUCTOR ACTIVITIES LEVEL 1

To illustrate mechanical fasteners:

1. Review an appropriate catalog to find examples of mechanical fasteners. Prepare a display and classify each fastener in term of:

   A. Permanent

   B. Semi-permanent

   C. Temporary

2. Present advantages and disadvantages of each type.

INSTRUCTOR ACTIVITIES LEVEL 2

1. Make a display of mechanical fasteners using actual and picture/sketches of the three types of fasteners:

   A. Permanent

   B. Semi-permanent

   C. Temporary

2. Explain where each type may be used for specific purposes.

INSTRUCTOR ACTIVITIES LEVEL 3

Prepare a display of ten fasteners that are in use on an object or objects, and explain what type of fastener was used and why it was selected. Describe an alternate mechanical fastener, if available and describe its advantages or disadvantages to the product.

COMPETENCY: 6.10 Describes a welding process

INSTRUCTOR INFORMATION:

Welding: many metals can be joined or separated using heat from an oxyacetylene torch. This equipment involves the use of oxygen and acetylene, regulators, hoses and a torch.

Electric welding is often done in two forms, resistance welding known as spot welding and shielded metal-arc welding known as arc welding.

Spot welding joins metal together by pressure and heat. Heat is produced by the resistance to the flow of electricity that melts and fuses the metal together.

Arc welding also uses heat from an electric arc to melt and fuse base metals and welded metal into one piece. There are both direct current (DC) and alternating current (AC) types of electric arc weldings.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the concept of welding:

1. Identify and present a safe demonstration of the equipment needed to perform the following types of welding:

   A. Oxyacetylene

   B. Spot

   C. Shielding welding DC

   D. Shielding welding AC

2. Explain and show five products in the room that were assembled with one of the welding procedures discussed.

INSTRUCTOR ACTIVITIES LEVEL 2

Prepare a demonstration with each of the various welding processes compare the finished welds and explain when and/or why each process is preferred.

INSTRUCTOR ACTIVITIES LEVEL 3

Teach students how to perform each of the welding processes listed in A - D and have them make sample welds on scrap metal pieces.

A. Oxyacetylene

B. Spot

C. Shielding welding DC

D. Shielding welding AC

COMPETENCY: 6.11 Describes a bonding process

INSTRUCTOR INFORMATION:

A bonding process: a major combining process used with materials. In bonding, the joint is the place where the materials are joined. Many types of adhesives are used to bond materials together in a process called adhesion. Adhesives all require time to cure or set-up.

Two materials that are similar can be joined by a fusion welding method. Usually only materials that are alike can be combined by fusion bonding. Materials can also be bonded using a chemical action with chlorinated solvents, and plastic cements; chemicals melt or soften some plastic materials thus joining them together.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the bonding process:

1. Select similar types of materials and carry out a bonding procedure demonstration as follows:

   A. Two pieces of hardwood

   B. Two pieces of softwood

   C. Two pieces of sheet metal

   D. Two pieces of metal foil

   E. Two pieces of plastic*

   F. Two pieces of cloth

2. Research the various types of bonding processes and display examples of as many examples as possible.

INSTRUCTOR ACTIVITIES LEVEL 2

1. Select similar types of materials and carry out a bonding procedure demonstration as follows:

   A. Two pieces of hardwood

   B. Two pieces of softwood

   C. Two pieces of sheet metal

   D. Two pieces of metal foil

   E. Two pieces of plastic*

   F. Two pieces of cloth

2. Research the various types of bonding processes and display

examples of as many examples as possible.

INSTRUCTOR ACTIVITIES LEVEL 3

Prepare a wall chart with various examples of materials that are bonded. Explain the bonding process and the materials involved. Use actual examples where possible.

* Refer to Competencies 2.3, 2.4, 2.5, and 2.6 for plastics information. Prepare hands-on experiences for students to work with each type of bonding in Level 1 and Level 2.

COMPETENCY: 6.12 **Describes a molding process**

INSTRUCTOR INFORMATION:

Molding process: requires that a solid material first be changed to a liquid. This is usually accomplished by heating the solid material until it melts. In its melted state, it is then poured or forced into a hollow form called a mold. The cavity inside the mold is filled with the molded material. After the material cools and hardens, it is removed for further manufacturing processing or final use. Often a mold release is applied by spraying it onto the mold to keep the final product from sticking to it.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the molding process:

Prepare some molds to make a product through the molding process as follows:

A. Plastics that must be heated

B. Liquid plastics that must be poured

C. Plaster or keene cement that must be poured

INSTRUCTOR ACTIVITIES LEVEL 2

Prepare some molds, then use them to make a product through one of the molding process as follows:

A. Plastics that must be heated

B. Liquid plastics that must be poured

C. Plaster or keene cement that must be poured

INSTRUCTOR ACTIVITIES LEVEL 3

1. Teach students how to design a mold, appropriate for the molding process and use it, then evaluate its effectiveness. Make modification as needed in the mold and use it again.

2. Explain the molding process (permanent molds, one shot molds) and demonstrate a simple molding of a plastic item.

3. Explain the casting process used in metals and ceramics. Demonstrate a simple Green Sand casting.

4. To reinforce the molding and casting processes prepare lessons to involve students in hands-on experience.

COMPETENCY: 6.13 Describes a casting process

INSTRUCTOR INFORMATION:

Casting process: also referred to as molding, involves pouring or forcing a liquid material into a hollow mold. Metal casting is a process involving pouring molten metal into a mold. During the cooling process the metal takes the shape of the mold.

Sand casting is accomplished by pressing a special molding sand around a pattern. The pattern is removed, gates are cut to and from the pattern and liquid metal is poured into the cavity. There are one-piece, split patterns, and full-mold foam polystyrene plastic patterns.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the casting process:

Make a sand casting pattern of a simple one piece part, demonstrate the casting process and explain safety and procedures in a step by step manner.

INSTRUCTOR ACTIVITIES LEVEL 2

1. Make a sand casting pattern of a one piece part and demonstrate the process emphasizing safety and precision.

2. Prepare lesson plans for hands-on experience for the students.

INSTRUCTOR ACTIVITIES LEVEL 3

1. Prepare a sand casting demonstration of each of the following:

   A. One piece mold

   B. Two piece mold

   C. Foam polystyrene pattern

2. Prepare lesson plan to explain and demonstrate plastics molding processes:

   A. Injection molding (ram, reciprocating-screw)

   B. Rotational molding

   C. Blow molding

   D. Compression molding

   E. Transfer molding

3. Prepare lesson plan to explain industrial casting processes (show examples of cast products):

   A. Sand casting

   B. Permanent-mold casting

   C. Investment casting

   D. Die casting

COMPETENCY: 6.14 Describes a forming process

INSTRUCTOR INFORMATION:

Forming process: changing the shape of an industrial material by stretching, compressing or bending by applying force.

1. Compressing or stretching where the material is shaped by squeezing or pulling through one of the following methods:

   A. Forging

   B. Bending

   C. Rolling

   D. Compression molding

   E. Drawing

2. Conditioning where the inside of the material is changed. Thermal conditioning and chemical conditioning are both processes that are used.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the forming process:

1. Prepare a display of examples of forming.

2. Explain how forming changes the size and shape of metal but does not change the volume.

3. Prepare a demonstration of metal stretching by applying force. Explain:

   A. Yield point

   B. Fracture point

INSTRUCTOR ACTIVITIES LEVEL 2

1. Present a demonstration of open dies to form an object.

2. Present lesson on various types of dies:

   A. Mated dies

   B. Shaped dies

3. Explain and demonstrate hot and cold forming.

INSTRUCTOR ACTIVITIES LEVEL 3

1. Plan lecture-demonstration and hands-on activities in forming processes:

2. Present information and safety practices in:

   A. Cold forming

   B. Hot forming

   C. Metal spinning

COMPETENCY: 6.15 Describes a laminating process

INSTRUCTOR INFORMATION:

Laminating: fiber glass is layering in plastic material. Laminated fiber glass parts are strong, light-weight, and do not rust or decay.

The fiber glass material used for the lamination is available in cloth or mat form. The cloth is woven, while the mat is made by pressing loose fibers together. By mixing a plastic resin with a catalyst, a substance is mixed that is used to coat the cloth. The cloth becomes stiff after the resin cures. The lamination process improves both the strength and appearance of the material.

A mold is often used to shape the plastic while it hardens. A mold release is used to assist with the separation of the mold, once the resin has hardened.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the concept of lamination:

1. Identify three products used regularly in a laminating process.

2. Laminate either fiber glass cloth or mat and prepare a laminated product using an existing mold as a class demonstration.

INSTRUCTOR ACTIVITIES LEVEL 2

1. Display and Identify five products used regularly in a laminating process.

2. Laminate either fiber glass cloth or mat and prepare a laminated product using an existing mold as a demonstration for the class.

INSTRUCTOR ACTIVITIES LEVEL 3

Teach students how to design and build an appropriate mold for laminating fiber glass. Then prepare the finished product, making adjustments in the mold as needed to prepare the best product.

COMPETENCY: 6.16 Describes a cutting process

INSTRUCTOR INFORMATION:

Cutting process: performed several ways in the manufacturing process. One of the best ways to cut steel is by using an oxyacetylene outfit with a cutting torch.

Another major way materials are cut during production, is with different types of saws as follows:

Hand saws--come in a variety of types and sizes for making rough to very smooth cuts in thick and thin materials.

Table saws--are power driven and used for making very accurate cuts in all types of materials.

Radial arm saws--are power driven and used for fast accurate cuts usually related to the building trades.

Band saws--make thick cuts in stock and cut curved surfaces well.

Jig saws--make thin cuts and cut curved surfaces well

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the cutting process:

Conduct a demonstration using as many of the cutting processes as there is equipment available in the shop/laboratory. Note the following items related to the cutting process performed by each cutting tool:

A. Speed at which it cuts

B. Thickness of material it can cut (maximum and minimum)

C. Smoothness of finished cut

D. Ease of operation

E. Guards and protective equipment needed

INSTRUCTOR ACTIVITIES LEVEL 2

Conduct a demonstration using as many of the cutting processes as there is equipment available in the shop/laboratory. Note the following items related to the cutting process performed by each cutting tool:

A. Speed at which it cuts

B. Thickness of material it can cut (maximum and minimum)

C. Smoothness of finished cut

D. Ease of operation

E. Guards and protective equipment needed

INSTRUCTOR ACTIVITIES LEVEL 3

Teach students how to make various cuts using the various cutting machines available. Make certain all safety rules are carefully followed.

COMPETENCY: 6.17 Explains layout and measurement

INSTRUCTOR INFORMATION:

Layout and measurement: directly related and often used to mean the same thing. Layout is the measuring and marking of materials to size. Tools commonly used in this process are:

Rules--used for measuring and transferring distances

Squares--(try, framing, combination, center) are used to layout and measure distances in a very accurate means

Dividers--used to transfer equal distances on stock

Center Punch--used to mark the center point for drilling holes in metal

Calipers--used to measure both inside and outside measurements

Micrometers--used to measure very accurately the diameters of stock

Scratch Awl--used to layout a template on metal stock and mark the center point for holes in wood

INSTRUCTOR ACTIVITIES LEVEL 1

To illustrate layout and measurement:

Demonstrate the layout of an object from paper to work materials selecting from the following tools:

A. Rulers

B. Squares

C. Dividers

INSTRUCTOR ACTIVITIES LEVEL 2

Make a sample layout on wood using the following tools:

A. Rule

B. Try-square

C. Framing square

D. T-bevel

E. Template

F. Marking gage

G. Dividers

INSTRUCTOR ACTIVITIES LEVEL 3

After explaining and demonstrating the common layout tools in your shop, assign and evaluate tasks requiring precision measurements.

COMPETENCY: 6.18 Outlines the process of combining components

INSTRUCTOR INFORMATION:

Combining components: a process where two or more materials or parts are put together. Parts and materials may be combined by several processes as follows:

Mixing is spreading evenly throughout the mixture, bits or particles of each ingredient.

Coating is covering one material with another for the purpose of decorating or protecting it. Plating is another method of coating.

Bonding is a major combining process. Many types of glues are used to bond materials together in a method called adhesion. Materials that are alike can be combined by fusion when the materials are melted at the joint and blended together.

Mechanical fasteners depend on friction for holding power and use screws, nails, bolts, staples and rivets.

INSTRUCTOR ACTIVITIES LEVEL 1

To illustrate the concept of combining components:

Present and explain six examples of components used daily to illustrate the processes of combining components. Make certain you have at least one example from each of the four processes.

INSTRUCTOR ACTIVITIES LEVEL 2

Demonstrate ten examples of components used daily that are examples of the processes of combining components. Make certain you have at least two examples from each of the four processes.

INSTRUCTOR ACTIVITIES LEVEL 3

Prepare a display that explains the four processes of combining components and include examples of the product or pictures of them.

COMPETENCY: 6.19 **Explains the distribution process and the relationship of packaging, labeling and storing**

INSTRUCTOR INFORMATION:

Distribution: requires that a finished product be protected during shipping. Many products need to be packaged to protect them and make them easier to handle.

Products are often stored in warehouses before they are shipped to the consumer. They are then transported by various means such as trucks, trains, boats, planes, or pumped into pipe-lines to be transported to the consumer.

The distribution of products often take the direction of:

1. Shipment from manufacturer, to wholesalers, to consumer

2. Shipment directly to the consumer

INSTRUCTOR ACTIVITIES LEVEL 1

To illustrate the concept of distribution:

1. Explain where local companies procure their products and how long it takes to receive them after being ordered.

2. Discuss problems that could occur in transit and the importance of labeling and packaging.

INSTRUCTOR ACTIVITIES LEVEL 2

Plan a class activity to mass produce a simple product. Assign students responsibilities for designing a distribution system to include, packaging, labeling, transporting, and displaying the product.

INSTRUCTOR ACTIVITIES LEVEL 3

Divide the class into two groups and have them mass produce the same product. Assign each group to design a different distribution system to include packaging, labeling, shipping and displaying the product. Compare the effectiveness of each group.

COMPETENCY: 6.20 Discuss five service occupations related to the manufacturing industry

INSTRUCTOR INFORMATION:

Service occupations: are plentiful in the manufacturing industry. Most durable products go through the following life cycle:

Install--or set up where it will be used. Connected to utilities, attached to drains, level etc.

Maintain--keeping it in working order, some must be lubricated and controls must be adjusted.

Repair--where worn or broken parts are replaced. Repairing often involves other steps much as diagnosing and/or correcting defects, and testing.

Replace--when it is not possible or economical to repair

INSTRUCTOR ACTIVITIES LEVEL 1

To help clarify the service occupations related to manufacturing:

Identify five occupations related to the product cycle of a product manufactured locally. Have students rank from 1 to 5 which of the service occupations they would enjoy most (1 lowest and 5 highest).

INSTRUCTOR ACTIVITIES LEVEL 2

1. Prepare a lesson plan to illustrate five or six service occupations found in a typical manufacturing industry. Supplement the lesson with audiovisual materials.

2. Plan a field trip, if possible, to a local manufacturing plant to observe service occupations and see people at work.

INSTRUCTOR ACTIVITIES LEVEL 3

1. Present audiovisual materials and conduct discussions on the importance of service occupations to the manufacturing process. Explain and discuss service occupations that require knowledge of science, mathematics, and language skills.

2. Plan role-playing activities to illustrate the relationship of service personnel to production personnel.

CONCEPT: 7.0

MANAGEMENT TECHNOLOGY

CONCEPT INFORMATION: Although there are many types of manufacturing systems, they have the same seven basic components.

1. Management that coordinates with a specific purpose
2. People, machines and materials that input the process
3. Money for expenses that pay for the people, machines and materials
4. Methods, or a way of doing things, bring together the money, people, machines and materials
5. Products that people make by changing the form of materials
6. Markets where the products are sold
7. Money for income that comes from the sale of the products. The money is used for two things- expenses and profit.

COMPETENCY: 7.1 Identify occupational levels of industrial management

INSTRUCTOR INFORMATION:

Within any industrial organization their are occupational levels in management. Within these levels the company is organized and authority granted to run the business. The typical levels in industrial management are:

Stockholders--with the final control

Board of Directors--that form policy

President--controls the day-to-day operation

Vice-President--control a major function or areas

Plant Manager--manages single facility

Department Heads--that manage an area

Supervisors--that assigns and supervises workers

Workers--that do the production work

INSTRUCTOR ACTIVITIES LEVEL 1

To assist in the identification of occupational levels:

Present lesson on information from the Dictionary of Occupational Title.

INSTRUCTOR ACTIVITIES LEVEL 2

Plan role-playing activities for a simulated manufacturing enterprise in the class.

INSTRUCTOR ACTIVITIES LEVEL 3

Form a corporation to produce a product in the shop. Assign students as representatives of the eight groups to role-play during the planning, production, and distribution process.

COMPETENCY: 7.2 Explain the importance of profit in free enterprise

INSTRUCTOR INFORMATION:

Profit: a basic goal of any company. Profit allows the company to:

1. Pay dividends to those who invested in the company
2. Become more productive
3. Develop new products and technology
4. Replace worn out equipment
5. Invest in other business

Without a reasonable profit there would be no business. Managers have the responsibility for making their companies profitable.

INSTRUCTOR ACTIVITIES LEVEL 1

Obtain (or develop) a profit statement from several local manufacturing companies that are publicly held.

INSTRUCTOR ACTIVITIES LEVEL 2

1. Plan lesson to explain the economic system in America and the importance of capital, stock, marketing, distribution, labor, management, quality and pricing. Explain how profit is necessary to the economy. Discuss profit margins, research costs, production costs, labor costs, overhead, personnel costs and competition.
2. Compare/contrast the Capitalist system and the Communist system.

INSTRUCTOR ACTIVITIES LEVEL 3

Form a small company to make a product to sell to the public. Follow organizational charts and procedures to manufacture and market the product. Sell stock to students. Keep accurate records of costs of materials and wages. Prepare a financial report to determine and explain profit (or loss) of the company.

COMPETENCY: 7.3 Chart the levels of authority within a corporation

INSTRUCTOR INFORMATION:

The major levels of authority within a corporation fall within the following structure:

President--responsible for all company activities

Vice-president--manages a major segment of the company

Plant manager--manages a single production facility

Department head--manages a major activity with the production facility

Supervisor--directs the work of production workers

Workers--completes work outlined by management

In addition there are a number of organization models, three of the most common are:

Line organization--all information and direction flows vertically up and down the structure.

Line and staff organization--the major line managers have staff officers to advise them. The line officers still have the authority over operations with the staff helping to make the management more effective.

Line and function staff organization when the staff function operates differently as they are given authority over their area. They move from advice giving to decision making.

INSTRUCTOR ACTIVITIES LEVEL 1

Obtain an organization chart from various manufacturing companies. Discuss with students the type of organizational models represented.

INSTRUCTOR ACTIVITIES LEVEL 2

Prepare lesson to explain the three types of organization models. Obtain audiovisual materials to illustrate each type.

INSTRUCTOR ACTIVITIES LEVEL 3

1. Plan a field trip to talk with managers, both line and staff, from a company and find out:

   A. What type of structure they operate under?

   B. Why they have their organizational structure?

   C. Would they like to see it changed?

   D. How long has the structure been in operation?

   E. Are there any changes being considered for the current structure?

2. Organize the class in a line and staff form when you teach manufacturing production.

COMPETENCY: 7.4 Outline the management planning process

INSTRUCTOR INFORMATION:

Planning is one of four management tasks:

Planning--determines the objectives and course of action to be followed

Organizing--distributing the work among others and setting up the lines of authority

Directing--encouraging the members of the group to carry out their tasks with a positive attitude

Controlling--insuring that the activities and results conform with the plans and objectives

The planning function is basically a four-step process consisting of:

1. Gathering information from reading, listening, and observing
2. Arranging information into meaningful pieces even when some of it may be missing
3. Considering alternatives with reasonable courses of action by which an objective can be reached.
4. Deciding is selecting the best set of objectives and related course of action.

INSTRUCTOR ACTIVITIES LEVEL 1

To illustrate the concept of management planning:

Take a manufacturing problem that needs to be solved related to your classroom/laboratory and demonstrate the four steps in the planning process:

A. Gathering information

B. Arranging information

C. Considering alternatives

D. Deciding on a course of action

INSTRUCTOR ACTIVITIES LEVEL 2

Create a manufacturing problem to be solved in your classroom/laboratory and demonstrate the four steps in the planning process:

A. Gathering information

B. Arranging information

C. Considering alternatives

D. Deciding on a solution

INSTRUCTOR ACTIVITIES LEVEL 3

Assign each class a problem that faces the entire industrial arts/technology program within the school and take them through the four step planning process to arrive at a solution. Compare each class solution with the other classes.

COMPETENCY: 7.5 Explain the utilization of computers in management

INSTRUCTOR INFORMATION:

Computers in management are used to:

1. Analyze the factors that affect production through the MRP program (Material Requirements Planning)
2. Keeping personnel records related to hiring date, pay, vacation time, benefits
3. Plant layout using interactive graphics to change a plant layout design
4. Word processing to produce the written documentation and correspondence that takes place
5. Spread-sheets for tracking the budgets and inventory control functions
6. Graphics to plot trends and show data graphically
7. Write orders from vendors when items are needed

INSTRUCTOR ACTIVITIES LEVEL 1

Discuss how managers use computers in a manufacturing enterprise. Explain and give examples of the seven areas where computers are practical and speed up information gathering and processing.

INSTRUCTOR ACTIVITIES LEVEL 2

Set up a computer demonstration related to a manufacturing enterprise in you shop/lab.

INSTRUCTOR ACTIVITIES LEVEL 3

1. Schedule a visit to the schools micro-computer laboratory and observe the use of the following computer applications for administrator/managers.

   A. Word processing

   B. Spread sheets

   C. Computer graphics

   D. Inventories

   E. Scheduling

   F. Attendance

   G. Accounting

2. Have the computer teacher present a lecture/demonstration for your manufacturing class.

COMPETENCY: 7.6 Describe five examples of computer usage in manufacturing

INSTRUCTOR INFORMATION:

Computers in manufacturing are used for:

1. Material Requirements Planning (MRP) is a way of estimating materials needed:

   A. To reduce the amount of materials that need to be stored

   B. To increase production

   C. To improve delivery efficiency of the finished product

2. Master Production Schedule (MPS) contains a list of all the parts and products to be made

3. CAD Computer Aided Design to design and illustrate the product

4. Inventory control to assist in keeping track of what is on-hand and what is needed

5. Automated Storage and Retrieval Systems to control movement of parts needed for production

INSTRUCTOR ACTIVITIES LEVEL 1

To assist in illustrating the use of computers in manufacturing:

Show a film and invite a guest speaker.

INSTRUCTOR ACTIVITIES LEVEL 2

Set up a computer to demonstrate to the class.

INSTRUCTOR ACTIVITIES LEVEL 3

1. Prepare lesson to demonstrate a computer to the class.

2. Invite the computer teacher to talk to the class or take the class to the computer lab in the school. Relate all information to manufacturing.

COMPETENCY: 7.7 Describe five steps in the manufacturing planning process

INSTRUCTOR INFORMATION:

Planning is a part of all manufacturing and goes through the following steps:

1. Identifying consumer demands to find out what consumers want
2. Designing and engineering products where the designers and engineers work closely together on the product
3. Planning a system to manufacture a product
4. Production detailing of products are planned by manufacturing engineers
5. Tooling-up for special jigs and machine setups with equipment moved into production position
6. Planning and quality control checks and tests on the product to assure high-quality products

INSTRUCTOR ACTIVITIES LEVEL 1

To illustrate the important of planning:

Select a simple product and discuss the major decisions that would be made from taking the product through the major planning steps of:

A. Identifying consumer demands

B. Designing and engineering products

C. Planning

D. Production

E. Tooling-up

F. Planning quality control

INSTRUCTOR ACTIVITIES LEVEL 2

Select a simple item to produce and discuss the major decisions that would be made from taking the product through the major planning steps of:

A. Identifying consumer demands

B. Designing and engineering products

C. Planning

D. Production

E. Tooling-up

F. Planning quality control

INSTRUCTOR ACTIVITIES LEVEL 3

Design a new item that has not been manufactured before and take it through the six steps with the students to determine the feasibility of production.

A. Identifying consumer demands

B. Designing and engineering products

C. Planning

D. Production

E. Tooling-up

F. Planning quality control

COMPETENCY: 7.8 Describe five administrative examples of data processing

INSTRUCTOR INFORMATION:

Data processing: anything that is done to or with data. Data are any collection of words or figures that have meaning. Data processing plays an important role in manufacturing for administrative personnel in such things as:

1. Tracking materials both raw and finished
2. Keeping track of time for workers
3. Cost of materials
4. Labor costs
5. Accounting
6. Advertising

Cards are used to punch data. This is a standard card divided into 12 rows and 80 columns.

The processing of the data involves four functions:

1. Recording
2. Classifying
3. Calculating
4. Summarizing

The technology of data processing has changed greatly with the new computer software systems available today.

INSTRUCTOR ACTIVITIES LEVEL 1

To illustrate the concept of data processing:

Prepare lesson and audiovisuals to teach the following:

A. Training required for the work

B. Equipment used

C. Working conditions

D. Pay

E. Advancement opportunities

F. Length of time in the area

G. Recent changes in the field

INSTRUCTOR ACTIVITIES LEVEL 2

Present information on the six areas where data processing is important to a manufacturing enterprise.

INSTRUCTOR ACTIVITIES LEVEL 3

Set up a corporation in the shop and ask the data processing teacher to assist with planning and in-putting functions for recording, classifying, calculating and summarizing data.

COMPETENCY: 7.9 Explain the purchasing function as related to manufacturing

INSTRUCTOR INFORMATION:

Purchasing: responsible for buying all of the materials, supplies, services, and equipment needed to operate a manufacturing company. The items must be:

1. In the right quantity
2. Of the right quality
3. Be ready when needed
4. Within the allotted budget

Purchasing becomes the channel between the manufacturing plant and the outside vendors. Communications must be strong concerning purchasing of materials, supplies, service, and equipment.

Most purchasing activities follow a procedure similar to these steps:

1. Completion of a purchasing request
2. Mailing of a bid request
3. Bid request is returned to company
4. Vendor is selected
5. Vendor prepared invoice
6. Receiving report is completed
7. Payment is made

INSTRUCTOR ACTIVITIES LEVEL 1

To assist the student with the concept of purchasing:

Prepare lesson about the schools purchasing function for the industrial arts/technology program to determine:

A. Forms used

B. Number of bids required

C. Length of bidding process

D. Time after materials are received that payment is made

E. How successful bidders are selected

INSTRUCTOR ACTIVITIES LEVEL 2

Prepare lesson on the purchasing activities necessary for a manufacturing enterprise. Explain the reason for procedures and record keeping related to bidding, purchasing, budgeting, discounting, receiving, and inventory control.

INSTRUCTOR ACTIVITIES LEVEL 3

Explain how you identify a piece of equipment that is needed by the school for the industrial arts/technology program and for which funding is available. Prepare an order and track it through the purchasing process.

COMPETENCY: 7.10 Describe four methods of cost control

INSTRUCTOR INFORMATION:

Cost control: needed by all companies. Costs are estimated long before a product is manufactured. By estimating costs, the selling price can be determined.

Usually four major items go into establishing costs of a product:

Materials--needed to manufacture the product which also includes any scrap

Labor--of the time workers spent making the product

Overhead--includes support staff, buildings, utilities, office supplies, and advertising. Usually anything that is not materials or labor costs is titled overhead.

Tooling-up--where needed, involves getting the tools and equipment ready for production.

The extent to which costs can be controlled; in these items which directly impacts cost controls.

INSTRUCTOR ACTIVITIES LEVEL 1

To assist the student to develop a concept of cost control:

Explain the major consideration in planning a product for manufacture in order to make a profit.

INSTRUCTOR ACTIVITIES LEVEL 2

Prepare a role-play mass production exercise and develop worksheets for studying and estimating costs, ie. labor materials, advertising, shipping, etc. Inform students of the planning and information necessary to assure a quality product that is competitively priced and makes a profit for the stockholders.

INSTRUCTOR ACTIVITIES LEVEL 3

Plan and design a product to be mass produced by the class. Follow the procedures of setting up a company and emphasize the production costs which must be considered. Decide, with the class, how costs can be minimized and controlled in order to make a profit.

COMPETENCY: 7.11 Discuss six reasons for profit

INSTRUCTOR INFORMATION:

Profit: is essential for a company to stay in business. The profit is used for many things such as:

1. Paying dividends to the investors
2. Becoming more productive
3. Developing new products and technology
4. Replacing old and out dated equipment
5. Investing in other companies
6. Providing employees with higher wages and benefits

Profit is necessary if the company is to develop and stay in business for the long run.

INSTRUCTOR ACTIVITIES LEVEL 1

To assist the students in building the concept of profit:

Prepare lesson about capitalism and free enterprise.

INSTRUCTOR ACTIVITIES LEVEL 2

Explain how companies must make a profit to pay wages, utilities, etc. Discuss how Research and Development must be an on-going process to improve the product and stay competitive in the market place.

INSTRUCTOR ACTIVITIES LEVEL 3

As a part of the mass production exercise, explain why profit is important to a company. Prepare lessons on gross profit, and net profit. List some ways profit is utilized to improve the product, increase advertising, modernize equipment, and benefit the employees.

COMPETENCY:7.12 Discuss four reasons for sales forecasts

INSTRUCTOR INFORMATION:

Sales forecasts: the anticipated sales for a period of time. This is usually broken down by product and model. A sales forecast is a little like a weather forecast for the sale of a product. It is important that the forecast be accurate to keep the company from producing far more that they can sell.

Making a sales forecast involves:

1. Surveying market potential by conducting market research to find out what people are buying and how much they are paying.

2. Gathering economic data about money matters from published government data and other sources.

3. Analyzing all information based on the sales forecast for accuracy.

4. Predicting sales and profit based on the forecast data helps to set the goals and standards for the company.

INSTRUCTOR INFORMATION LEVEL 1

To assist the student with the concept of sales forecasts:

Prepare lesson on the following activities:

A. Definition of sales forecast

B. Uses for sales forecasts

C. Importance of accuracy in forecasting

INSTRUCTOR INFORMATION LEVEL 2

Present lesson on marketing and market research and explain the importance of sales forecasting. Conduct a class discussion about methods of sales forecasting.

INSTRUCTOR ACTIVITIES LEVEL 3

Select one of the products that was designed and manufactured in previous competencies and discuss the sales forecast that was done for that product and what actual sales were realized. Was the forecast accurate? Why? Or why not?

COMPETENCY: 7.13 Explains three means of identifying consumer demands

INSTRUCTOR INFORMATION:

Consumer demands: when people want or need a certain product. Consumer demands are often determined by:

1. Consumer surveys that ask consumers questions about the products they use.
2. Product samples can be shown to people to find out their interest.
3. Telephone surveys are used to ask people what they use and how they like it.
4. Written surveys that sample a cross-section of people on specific questions.

INSTRUCTOR ACTIVITIES LEVEL 1

To assist the students with identifying consumer demands:

Select a product that students in the school would be familiar with and conduct a consumer survey to determine the student's feelings about:

A. Cost

B. Reliability

C. Usefulness

D. Visual appeal

E. Recommended product changes

INSTRUCTOR ACTIVITIES LEVEL 2

Plan activities to involve students in developing a market survey about a proposed product to be mass produced in the shop. Use the results to change the product or proceed with production. Discuss the importance of consumer demand.

INSTRUCTOR ACTIVITIES LEVEL 3

1. Assign students to small groups to select a product of their choice and take it through the following four steps of consumer surveying:

   A. Consumer survey

   B. Product sample

   C. Telephone survey

   D. Written surveys

2. Written group reports should be prepared and discussed.

COMPETENCY: 7.14 Describes six concepts within the marketing function

INSTRUCTOR INFORMATION:

Marketing: is the flow of goods from the producers to the consumer. Marketing involves:

1. Market research involving knowledge of the market that one must gather before any wise product development or marketing decisions can be reached.

   A. Who and where the customer is?

   B. What the customer needs and wants to buy?

   C. How much the customer will pay for it?

   D. Where the customer will buy it?

2. Advertising is an information-spreading activity. There is product advertising and idea or name advertising.

3. Sales involving the exchange of products for money. This function is divided into two major activities: sale planning and sales operation.

4. Distribution is the path a product takes from the producer to the consumer.

INSTRUCTOR ACTIVITIES LEVEL 1

To assist the students in learning the concept of marketing:

Explain and give examples of marketing techniques. Discuss market research, advertising, packaging and distribution.

INSTRUCTOR ACTIVITIES LEVEL 2

Prepare materials on several well-known products to illustrate good marketing techniques. Conduct discussions of the products and the importance of name recognition and the impact of advertising.

INSTRUCTOR ACTIVITIES LEVEL 3

Assign students to work in groups and take a product through the four steps in marketing. Prepare written reports on the results. Discuss each group report with the class.

COMPETENCY: 7.15 States the five steps in the problem solving method

INSTRUCTOR INFORMATION:

Problem solving: is built around five major steps as follows:

1. Define the problem clearly and concisely
2. Determine factors that are associated and related to the problem
3. Obtain information about the factors that have been identified
4. Determine possible solutions based on facts and information
5. Test results to find solution

INSTRUCTOR ACTIVITIES LEVEL 1

To assist the student in developing problem solving skills:

Assign a problem related to the classroom/laboratory, and assist students in going through the five steps of the problem solving solution. Direct the class as a whole and put information on flip charts or the board.*

INSTRUCTOR ACTIVITIES LEVEL 2

Divide the class into groups of 4 or 5 each and give each group the same problem to solve. Then have them take it through the five steps and decide on a solution. Each group should have a leader to keep the group on track and report the group solution to the entire class.*

INSTRUCTOR ACTIVITIES LEVEL 3

Divide the class into small groups and have each group select a problem from a list on the board. Their task will be to take the problem through the 5 steps to arrive at a solution.*

*NOTE for all three levels:

Present lessons on Research and Development and the need for clearly stating a problem to be solved. Provide historical information about major manufacturers' efforts to improve their product or expand the uses for the product. Define applied research, basic research, and pure research.

COMPETENCY: 7.16 Describes the steps involved in research and development

INSTRUCTOR INFORMATION:

Research and development: manufacturing produces new knowledge and new processes or products for the manufacturer. These processes go on continually and involve:

1. Retrieving what was, and collecting information related to the new knowledge needed.

2. Describing what is, provides knowledge of the nature or features of materials, processes, or products.

3. Experimenting with what will be, if some things are changed and others are not.

INSTRUCTOR ACTIVITIES LEVEL 1

To assist students with research and development:

Select a local company with a Research and Development Department and gather information to discuss:

A. Number of people involved?

B. Training required?

C. Equipment needed?

D. Working conditions?

E. Types of products worked on?

INSTRUCTOR ACTIVITIES LEVEL 2

Select audiovisual materials to show how major companies improve products through research and development. Conduct class discussions of the need for research and development for the space flight program.

INSTRUCTOR ACTIVITIES LEVEL 3

Give students ideas for a product that needs to be developed and have them work up a complete R & D function report.

COMPETENCY: 7.17 **Describes four reasons for the use of prototypes in the manufacturing process**

INSTRUCTOR INFORMATION:

Prototypes: are made from working drawings. There are three major reasons for making prototypes.

1. To test the plan
2. To test the product
3. To see how to manufacture the product

Prototypes are custom-made as a single unit or in small quantities. Most of the work is done by hand, and is therefore expensive.

After a prototype is finished, it is tested, which may involve destroying it during the testing. Consumers are often involved in evaluating the prototype. A prototype is built, tested and then used in preproduction planning.

INSTRUCTOR ACTIVITIES LEVEL 1

To assist students in developing the concept of a prototype:

Prepare lessons and audiovisual materials to show the development and use of prototypes. Explain the roles of Designers, Engineers and Drafters in developing mock-ups and prototypes.

INSTRUCTOR ACTIVITIES LEVEL 2

Teach students how to develop a simple prototype of a new hand and test it with possible consumers. Analyze how many of the processes that were completed by hand for the prototype, could be done by machines in mass-production.

INSTRUCTOR ACTIVITIES LEVEL 3

Assign students to build a prototype of a simple product and keep careful records of the time involved for each step. Then set it up for mass production and compare the time required for each step and the total project time.

COMPETENCY: 7.18 **Designs a small manufacturing facility (using a flow chart and instructor provided information)**

INSTRUCTOR INFORMATION:

Plant layout: a second task of a manufacturing engineer involving:

1. Assignment of space within the plant

2. Physical arrangement of equipment within the assigned area

Plant layout should provide a good flow allowing parts and products to move steadily through the plant. The flow of people is also considered with entrances, exits, and aisles. A good plant layout will shorten the manufacturing cycle needed to make a part, subassembly or product. The type of manufacturing carried on in the plant directly impacts the plant layout decision.

Continuous manufacturing works best when the production equipment is grouped by product. This requires a product layout where the equipment is arranged to handle the step-by-step sequence of operations required by the product.

INSTRUCTOR ACTIVITIES LEVEL 1

To assist the students with designing a small manufacturing facility:

Layout a small manufacturing facility in the classroom/laboratory utilizing the flow chart.

INSTRUCTOR ACTIVITIES LEVEL 2

Prepare lessons on shop layout based upon production flow charting. Show students how to plan a simple shop layout based on the production steps necessary to produce a simple item.

INSTRUCTOR ACTIVITIES LEVEL 3

1. Present lesson on production flow-charting of two different items and instruct students on processes to determine work stations, parts flow, and material handling. Have students work in teams to develop sketches of possible shop layouts to organize the work flow of each item.

2. Review and discuss the plans to arrive at the most workable solution for your facility.

COMPETENCY: 7.19 Describes five occupations in production planning

INSTRUCTOR INFORMATION:

Occupations: production planning involves the jobs done before production starts. Some of the occupations involved are:

1. Manufacturing engineers who plan and direct the line production
2. Manufacturing technologists who assist the manufacturing engineer with their work
3. Production engineers is a term given to both manufacturing engineer and manufacturing technologists in some manufacturing plants.

A number of tasks are a major part of production planning:

Routing--determines where each operation on a part, subassembly or product is to be done

Scheduling--tells production managers when an operation is to be performed and when the work it to be completed

Dispatching--involves issuing production orders as work is scheduled

Expediting--checking to see that the production schedules are met.

Quality control is the function responsible for maintaining a certain level of excellence among like products. It has two major parts:

1. Programs, a system for seeing that quality is built in
2. Inspection, compares the product against quality standards

INSTRUCTOR ACTIVITIES LEVEL 1

To assist the students with occupations related to production planning:

Prepare lesson from the Dictionary of Occupational Titles on specific job titles to find:

A. Job description

B. Training required for the position

C. Pay range

D. Future of the job

E. Geographic areas

INSTRUCTOR ACTIVITIES LEVEL 2

Present audiovisual materials about modern industry and discuss the changes that have taken place on a result of computer, robotics, CAD, CAM, and the space program.

INSTRUCTOR ACTIVITIES LEVEL 3

1. Bring in a guest speaker for students to interview, or observe local manufacturing operation to gain insight into specific occupations involved. Discuss training and education required, and future of the positions.

2. Present information on the changes in the manufacturing industry over the past 5-10 years, because of automation.

COMPETENCY: 7.20 Estimates the cost of a group manufacturing project

INSTRUCTOR INFORMATION:

The cost of manufacturing a product is based upon four factors:

1. Materials needed to manufacture products which also includes any scrap.

2. Labor of the time workers spend making the product.

3. Overhead includes support staff, building, utilities, office supplies and advertising. Usually everything that is not materials or labor costs is titled overhead.

4. Tooling-Up where needed-involves getting the tools and equipment ready for production.

INSTRUCTOR ACTIVITIES LEVEL 1

To help students estimate costs of a group project:

Teach students how to design a small project that could be mass produced in the schools classroom/laboratory and establish costs in each of the four categories.

INSTRUCTOR ACTIVITIES LEVEL 2

Assign students through the development and design of a product, to design a mass produced product to be produced in the school classroom/laboratory. Establish costs in each of the four categories.

INSTRUCTOR ACTIVITIES LEVEL 3

Guide students through the development and design of a product to be mass produced in the school classroom/laboratory and establish costs in each of the four categories.

COMPETENCY: 7.21 Performs a time and motion study

INSTRUCTOR INFORMATION:

Time and motion: studies determine the total time needed to complete a given operation. The results from timing the operation several times and computing the average time involved is called work measurement. Then a 15 % allowance for fatigue, breaks and delays is added on. This is called allowance time. The total operation time is the total of the average time plus 15 %.

INSTRUCTOR ACTIVITIES LEVEL 1

To assist the students with the concept of time and motion:

Demonstrate how to perform a time and motion study on the operations involved in their mass production project designed in competency 7.20.

INSTRUCTOR ACTIVITIES LEVEL 2

Demonstrate how to perform a time and motion study on the operations involved in their mass production project designed in competency 7.20.

INSTRUCTOR ACTIVITIES LEVEL 3

Demonstrate how to perform a time and motion study on the operations involved in their mass production project designed in competency 7.20.

COMPETENCY: 7.22 Describes production control in the manufacturing process

INSTRUCTOR INFORMATION:

Production control: can be very complex. Parts must arrive on time and they must be moved to the right place. The computer is used to assist in this operation.

Major factors involved in production control are:

Order/options--sent to the assembly plant and entered into the computer

Schedule--made for each work period. The schedule lists the parts needed at each work station and the sequence in which the part will be sent

Assembly lines--using various conveyor systems

Correction--if an error is made, but great care is taken to minimize the errors

INSTRUCTOR ACTIVITIES LEVEL 1

To assist students in developing a concept of production control:

Prepare materials to analyze the mass production procedure completed in competency 7.20 and see how each of these factors impact upon its effectiveness.

INSTRUCTOR ACTIVITIES LEVEL 2

Prepare materials to analyze the mass production procedure completed in competency 7.20 and see how each of these factors impact upon its effectiveness.

INSTRUCTOR ACTIVITIES LEVEL 3

Prepare materials to analyze the mass production procedure completed in competency 7.20 and see how each of these factors impact upon its effectiveness.

COMPETENCY: 7.23 Describes quality control in the manufacturing process

INSTRUCTOR INFORMATION:

Quality control: everyones responsibility in the manufacturing process. To assure that a product meets the company's standards two tasks are carried out:

1. Motivating workers to produce quality products. Today "quality circles" and "quality of work live circles" are used by some companies to have workers involved.

2. Inspecting products to remove any substandard items is also important. Inspectors check:

   A. Materials that the plant receives

   B. Purchased parts

   C. Work-in-progress

   D. Finished products

INSTRUCTOR ACTIVITIES LEVEL 1

To assist the student with the concept of quality control:

Design a quality control program for improving the products manufactured in previous competencies.

INSTRUCTOR ACTIVITIES LEVEL 2

Design a quality control program for improving the products manufactured in previous competencies.

INSTRUCTOR ACTIVITIES LEVEL 3

Design a quality control program for improving the products manufactured in previous competencies.

CONCEPT: 8.0

KNOWLEDGE OF AN ENTERPRISE

CONCEPT INFORMATION: An enterprise is a business and may also be referred to as companies, firms, corporations, establishments, and other more technical terms. Enterprises come in many different sizes and shapes and are operated many different ways.

Our economic system is based on the willingness of enterprising people willing to take risks. They hope to make a profit from resources to produce a product.

There are many different types, sizes and shapes of enterprises but they all have certain things in common.

COMPETENCY: 8.1 Defines the term enterprise

INSTRUCTOR INFORMATION:

Enterprise: to most people means business. Business enterprises are also called companies, firms, corporations, establishments, and other more technical terms.

There are many different sizes of enterprises but they all have certain things in common. Owners and managers of enterprises must be willing to take risks in order to make profits. An enterprise is an organization which uses resources to produce products or perform services as a profit for the owners. The chance to make a profit is what encourages many to be enterprising.

INSTRUCTOR ACTIVITIES LEVEL 1

To assist students with the concept of enterprise:

Define and discuss the term enterprise and then interview five students to determine their definition of the word enterprise.

INSTRUCTOR ACTIVITIES LEVEL 2

Define and discuss the term enterprise in relation to manufacturing. Explain the essential components of a successful company.

INSTRUCTOR ACTIVITIES LEVEL 3

1. Explain the American economic system and the place of private enterprise within the system.

2. Conduct discussions on the characteristics of successful enterprises and unsuccessful enterprises.

COMPETENCY: 8.2 **Explains management's responsibilities to owners, employees, customers and the general public**

INSTRUCTOR INFORMATION:

Management has responsibilities to several groups of people.

Owners--to make a reasonable profit. Profit is more than responsibility, it is a basic survival requirement.

Employees--who put their labor and lives into the enterprise.

Customers--satisfy the needs and wants of the buyer. The product purchased must work as well and as long as the manufacturer said.

Public--create a positive effect on local communities, state and national governments.

INSTRUCTOR ACTIVITIES LEVEL 1

To assist the student with management's responsibilities:

Select a manufacturing company in your area and interview the four groups of people involved, to the extent possible. Determine how they feel about the company and its product.

A. Owners

B. Employees

C. Customers

D. Public

INSTRUCTOR ACTIVITIES LEVEL 2

Take the class to visit a local manufacturing company to see how they deal with any problem or dissatisfaction on the part of the four groups and the company.

INSTRUCTOR ACTIVITIES LEVEL 3

Discuss the hypothetical company the students formed to produce a product in the class, and how such a business would impact upon the four groups of people in the local community.

COMPETENCY: 8.3 Describes the three types of ownership

INSTRUCTOR INFORMATION:

Owners: are often a different group than the people who manage and help the company grow. There are three basic types of ownerships available to people starting a business, each with certain advantages and disadvantages.

Single proprietorship--a business enterprise totally owned by one person. It is usually easy to form, owner has complete control and keeps all profit, records are private and it is easy to end or change direction.

Partnership--two or more people in a business. This is really an extension of a single proprietorship.

Corporation--the best suited form of ownership for most manufacturing enterprises. This allows many people to buy shares and parts of the ownerships. A stockholder is only responsible for business debts up to the amount of their investment.

INSTRUCTOR ACTIVITIES LEVEL 1

To assist students with the concept of ownership:

Invite students to talk with owners of single proprietorship and partnership manufacturing business, visit the class to discuss:

A. How long they have been in operation?

B. Why they started their own business?

C. What do they like best about owning their own business?

D. What do they like least about owning their own business?

E. What do they plan to be doing 5 years from now?

INSTRUCTOR ACTIVITIES LEVEL 2

Select a manufacturing product that involves all three forms of business and discuss with each business group their role in the total product. See what they would like most to change about their business.

INSTRUCTOR ACTIVITIES LEVEL 3

Present a lecture to the class to explain the advantages and disadvantages of each of the three types of ownership. Relate their information to the mass production experiences the class has had earlier.

COMPETENCY: 8.4 Describes capital as used in manufacturing

INSTRUCTOR INFORMATION:

Capital: is the money that is used to run the company. It involves the plant and equipment used to produce products.

Sources of capital are:

Stocks--or shares of the company that are sold to raise money

Bonds--are more like bank loans, in that people do not own any part of the company.

Bank loans--where a company signs a note with the bank to pay back the money.

Short-term credit--are items that a company buys and can take a few month to pay for, such as tools, raw materials, and office supplies.

INSTRUCTOR ACTIVITIES LEVEL 1

To assist students with the concept of capital:

Discuss:

A. Stocks

B. Bonds

C. Bank loans

D. Short-term credit

INSTRUCTOR ACTIVITIES LEVEL 2

Present information about the importance of capital in the free enterprise system. Discuss each of the four means of financing and explain the necessity of credit and credit ratings.

INSTRUCTOR ACTIVITIES LEVEL 3

Invite a local banker to talk about how companies secure capital and the involvement of the banking industry in helping them secure capital to form or operate a company.

COMPETENCY: 8.5 Defines the term management

INSTRUCTOR INFORMATION:

Management: guiding and directing the company's activities in an efficient manner.

Management has four functions:

Planning--goals and courses of action to be followed.

Organizing--dividing tasks into jobs and establishing lines of authority.

Directing--assigning employees to jobs and encouraging them to complete their work efficiently.

Controlling--comparing the results of employee's work with the company plan.

INSTRUCTOR ACTIVITIES LEVEL 1

To assist the students with the concept of management:

Organize the class to completely clean and reorganize the class/laboratory in the school by going through the four steps of management.

INSTRUCTOR ACTIVITIES LEVEL 2

Assign students to role play as managers of the school shop company. They will be responsible for utilizing the four functions of management to operate the new business.

INSTRUCTOR ACTIVITIES LEVEL 3

Develop a class project to plan a large school function by going through the four steps of management. The project could be a fund raiser, maintenance activity, or a school spirit activity. (This would work well as an AIASA function.)

COMPETENCY: 8.6 Interpret the meaning of incorporation

INSTRUCTOR INFORMATION:

Incorporation: form a company as a legal business unit. It can be incorporated in one state but still operate in others. Corporations can own property, can sue, be sued and enter into contracts.

Corporations can last a long time as owners sell their ownership without causing a change in management. Corporate owners have a definite advantage in that they have limited liability.

Corporations also have some disadvantages. The owners often have little interest in daily operations of the company as they are mainly interested in dividends.

A corporation is controlled by three major things:

1. The laws of the state where it is formed
2. The corporations articles of incorporation
3. The corporations by-laws

INSTRUCTOR ACTIVITIES LEVEL 1

To assist the students in developing the concept of incorporation:

Prepare lecture materials to explain the process of incorporation in Arizona. Discuss the advantages and disadvantages of incorporation for small businesses.

INSTRUCTOR ACTIVITIES LEVEL 2

Talk with local manufacturing companies to secure a copy of their incorporation for study. Compare the papers and discuss the similarities and differences with the class.

INSTRUCTOR ACTIVITIES LEVEL 3

Talk with a lawyer about incorporation activities in terms of what is involved in terms of legal fees and time. Prepare materials to present to the class.

COMPETENCY: 8.7 Describe an organizational chart for a small corporation

INSTRUCTOR INFORMATION:

Most organization charts for small corporations will follow this pattern:

President--responsible for all company activities

Vice-president--manages a major segment of the company

Plant manager--manages a single production facility

Department head--manages a major activity with the production facility

Supervisor--directs the work of production workers

Workers--completes work outlined by management

INSTRUCTOR ACTIVITIES LEVEL 1

To assist students in learning about organizational charts:

Develop an organization chart for the class and relate it to a manufacturing enterprise.

INSTRUCTOR ACTIVITIES LEVEL 2

Explain the association of AIASA and relate the officers and their responsibilities to an organization chart for a small company that could be formed in the class.

INSTRUCTOR ACTIVITIES LEVEL 3

Set up an organizational chart for the class after explaining AIASA and operate the class as a small manufacturing company.

COMPETENCY: 8.8 Explains at least four steps in planning an enterprise

INSTRUCTOR INFORMATION:

The planning of an enterprise involves the following four steps:

1. Preparation of articles of incorporation that usually contain:

   A. Name of the company

   B. Purpose for forming the company

   C. Names and addresses of those forming it

   D. Location of the company office in the state

   E. Type and value of the stock to be sold

   F. Names of principal officers of the company

2. Receiving the corporation charter after the state officials review the articles of incorporation. The charter is like the corporate "birth certificate".

3. Preparation of by-laws provide the detail of how the corporation will be run.

4. Legal incorporation then develops a management structure to run the corporation.

INSTRUCTOR ACTIVITIES LEVEL 1

To assist students with the planning of an enterprise:

Contact the state to find out what is involved and what forms and fees are required for incorporation in the state.

INSTRUCTOR ACTIVITIES LEVEL 2

Obtain the necessary forms for incorporation and complete them for XYZ company. Have someone familiar with incorporation review the forms and provide feedback for accuracy.

INSTRUCTOR ACTIVITIES LEVEL 3

Review the plans and actions that were taken in setting up the mass production experience. Explain the different types of ownerships, sole proprietorships, partnerships, and corporations.

COMPETENCY: 8.9 Identifies six responsibilities of an employee to an employer

INSTRUCTOR INFORMATION:

If employees are to develop into safe and successful workers they must possess the following attitudes toward their job and their employer:

Promptness--being there on time each day

Regular attendance--every person has an important job to do each day, it often creates problems when someone else has to do their job because they did not show up.

Cooperation--the main reason most people lose their job. Listen to and work with supervisors and fellow workers.

Reliability--being trusted by the company to do a job. A willingness to accept responsibility.

Persistence--means not giving up easily. Sticking to difficult tasks to see them through.

Patience--one who does not blow-up and is difficult to work with.

INSTRUCTOR ACTIVITIES LEVEL 1

To demonstrate the responsibilities that employees have to their employer:

Present the following six factors and discuss student opinions on each as related to working in this class:

A. Promptness

B. Regular attendance

C. Cooperation

D. Reliability

E. Persistence

F. Patience

INSTRUCTOR ACTIVITIES LEVEL 2

After discussing and defining the following six factors related to working in manufacturing, ask students to rank the six and rate themselves on each factor.

A. Promptness

B. Regular attendance

C. Cooperation

D. Reliability

E. Persistence

F. Patience

INSTRUCTOR ACTIVITIES LEVEL 3

Invite one or two Personnel Directors to be guest speakers and tell the class:

A. What they expect from their employees

B. What is most important toward promotion

C. What most often leads toward dismissal

COMPETENCY: 8.10 Explains why manufacturing lends itself to big business

INSTRUCTOR INFORMATION:

A manufacturing enterprise is a factory-based, profit-making organization. It uses a great many resources to produce products. The materials they use are processed and made more usable or valuable to the consumer. Manufacturing usually refers to making products by machine, usually in large quantities that are mass produced.

All of the equipment, materials and personnel needed to carry out most manufacturing operation, is so large that it takes a large business operation to raise the capital, secure the materials, manufacture the products and distribute it to the consumer on a profit making basis.

INSTRUCTOR ACTIVITIES LEVEL 1

To assist students with manufacturing as big business:

Discuss the five major activities that are found within a manufacturing enterprise:

A. Research and development

B. Production

C. Marketing

D. Industrial relations

E. Financial affairs

INSTRUCTOR ACTIVITIES LEVEL 2

1. Discuss the five major activities that are found within a manufacturing enterprise:

   A. Research and development

   B. Production

   C. Marketing

   D. Industrial relations

   E. Financial affairs

2. Ask students to tell which area they would like to work in and why.

INSTRUCTOR ACTIVITIES LEVEL 3

Visit a local manufacturing company and discuss with them the major activities that are found in their enterprise. Plan lesson to present information to the class. Explain the five major areas, personnel, purchasing, equipment needs, and profit.

COMPETENCY: 8.11 Describes five start-up problems facing an enterprise

INSTRUCTOR INFORMATION:

There are many start-up problems facing any new enterprise. Many of them are:

1. Preparing articles of incorporation
2. Receiving a state charter
3. Preparing a set of by-laws
4. Electing a board of directors
5. Developing a management structure
6. Organizing the management team
7. Financing the enterprise

INSTRUCTOR ACTIVITIES LEVEL 1

To assist students with start-up problems facing an enterprise:

Talk to several small manufacturing business owners what have started a new business in the last few years. Ask them how they dealt with the seven start-up problems.

INSTRUCTOR ACTIVITIES LEVEL 2

Talk to several small manufacturing business owners what have started a new business in the last few years. Ask them how they dealt with the seven start-up problems. Prepare materials and information on each business to present to the class. Discuss the similarities and/or differences.

INSTRUCTOR ACTIVITIES LEVEL 3

Talk to a medium to large manufacturing business that has started a new business in the last few years. Invite an officer or manager to speak to the class about the start-up problems that were encountered. Plan a field trip to the company.

COMPETENCY: 8.12 Describes the three main functions of Research and Development for a new product

INSTRUCTOR INFORMATION:

Research and development: There are three main functions involved in research and development, each with certain tasks to be performed.

Research--a systematic search process for the unknown facts and principles. Through research we develop and discover new knowledge that is very important to manufacturing enterprises.

Development--involves finding the most economical and practical methods of using the facts and principles found by research activities. Through development the ideas of research become products and processes.

Product engineering--includes the activities in the final product and design work. Product engineers prepare the drawings, performance standards and describe other qualities of the product and all its parts. A close relationship also must exist with production and marketing personnel as a product is produced for the market.

INSTRUCTOR ACTIVITIES LEVEL 1

To assist students with research and development activities:

Select a simple project and take it through the three main functions involved in research and development. Include some detail in each of the three steps.

INSTRUCTOR ACTIVITIES LEVEL 2

Select a simple project and take it through the three main functions involved in research and development. Include as much detail in each of the three steps as possible.

INSTRUCTOR ACTIVITIES LEVEL 3

Set up a research and development function and prepare a new product for your classroom by setting up a research and development function and taking the new item through the three steps, including as much detail as possible.

COMPETENCY: 8.13 Explains the six steps involved in new product development within the research and development process

INSTRUCTOR INFORMATION:

In developing new products a practical, managed series of steps is followed. The process involves the three main functions of research and development:

1. Research
2. Development
3. Product engineering

There are six additional steps involved in a very careful movement:

1. Finding product ideas
2. Screening the product ideas
3. Designing and developing of the product
4. Surveying the market
5. Specifying product characteristics
6. Getting management's approval of developed products

INSTRUCTOR ACTIVITIES LEVEL 1

To assist students:

Select a simple product that students could develop and take it through the six steps of the planning stage:

A. Finding ideas

B. Screening ideas

C. Designing and developing the product

D. Surveying the market

E. Specifying product characteristics

F. Getting management's approval

INSTRUCTOR ACTIVITIES LEVEL 2

Select a simple product that students could develop and take it through the six steps of the planning stage. Prepare lessons explaining the importance of research and development in industry.

INSTRUCTOR ACTIVITIES LEVEL 3

Select a product that students could to develop and take it through the six steps of the planning stage. Set up for production after completing the six steps

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INDUSTRIAL ARTS TECHNOLOGY

PREFACE

The Arizona Industrial Arts Technology Guide is designed to provide uniform direction for programs throughout Arizona. The Guide will assist teachers, counselors, administrators, and parents, in understanding the potential of Industrial Arts Technology. An overview of articulation in Industrial Arts Technology is provided.

Arizona Industrial Arts Technology courses provide student learning experiences integrated within these general technological programs:

* General Industries
* Construction
* Drafting and Design
* Electricity/Electronics
* Energy, Power, Transportation
* Visual Communications
* Manufacturing

This Guide has been developed to reflect nationally endorsed direction and standards of the Industrial Arts Technology profession. The programs reflect federal funding categories within the Classification of Instructional Programs (CIP's) codes developed by the National Center for Education Statistics.

INDUSTRIAL ARTS/ TECHNOLOGY EDUCATION PHILOSOPHY

Industrial Arts Technology prepares youth through experiences that teach hands-on skills and develop individual potential. Learning activities enable students to develop understanding of technical, consumer, occupational, recreational, social, historical, cultural, and free enterprise concepts. Students acquire knowledge of industry, and related math science competencies, through simulated industrial activities such as: Experimenting, problem solving, planning, designing, constructing, evaluating, and using tools, machines, materials, and processes. Industrial Arts Technology provides a continuum of experience and activities that further the discovery and development of each student's technical awareness, self-reliance, and resourcefulness to succeed as an effective individual in our technological society.

Industrial Arts Technology recognizes the individual's potential and provides learning experiences that contribute to growth and development commensurate with interest and ability. Thus, Industrial Arts Technology is a fundamental study for all students regardless of educational goal or occupational pursuit.

DEFINITION

Industrial Arts Technology includes the body of related subject matter organized for the development of understanding about industry, including learning experiences involving experimenting, designing, constructing, marketing, evaluating, testing, and the application of tools, machines, and processes of industry.

Industrial Arts Technology:

* Assists students in making meaningful occupational choices in occupational and educational planning, or preparing for advanced occupational, technical, or professional education programs.

* Assists students in developing leadership skills.

* Assists students in becoming knowledgeable consumers who understand profit and loss, supply and demand, quality of products, advertising, and marketing.

STATEMENT OF PURPOSE

Industrial Arts is a curriculum area which teaches students about industry and its technology. Primary emphasis includes:

* Development of positive work attitudes and practices.

* Appropriate use of tools and requirements.

* Career opportunities and requirements.

* Development of knowledge base for educational and occupational planning.

* Preparation for entry into advance occupational, technical, or professional education programs.

* Development of leadership and followership abilities.

* Development of pride in workmanship, scholarship, and craftsmanship.

* Application of Safety standards.

* Focus upon the potential influence of future industrial technology.

INDUSTRIAL ARTS TECHNOLOGY EDUCATION PROGRAMS

DESCRIPTION

Industrial Arts Technology Education programs include awareness, exploration, and core courses. A key to the programs is adaptability and flexibility. Students exhibit a wide range of interests, abilities, and life goals; and the industrial arts technology education programs provide courses of instruction with options of exploring industrial areas based on interest or need.

INSTRUCTIONAL EMPHASIS

* Developing a knowledge base for educational and occupational planning to prepare students for enrollment in advanced technical, occupational, or professional education programs.
* Understanding industry, technology, and free enterprise.
* Understanding industrial processes and the practical application of scientific principles.
* Developing fundamental skills with industrial tools, materials, and processes.
* Problem-solving involving the materials, processes, and products of industry.
* Student management and leadership learning activities.
* Inclusion of AIASA activities and membership availability.
* Relating technology to academic subject areas.
* Develop an understanding of potential industrial, technical, and professional opportunities, and increase knowledge which will help students obtain and maintain employment.
* Develop competencies that contribute to responsible citizenship through technological understanding, consumer knowledge, and the beneficial use of leisure time.

ELEMENTS

To accomplish this purpose, the Industrial Arts Technology Education program shall provide:

* **Exploration of Industrial Practices**

  Experiences in laboratories to develop individual skill and creative abilities in the safe and proper application of tools, machines, materials, processes, and products representing (or depicting) current industry.

* **Preparation for Advanced Training**

  Industrial experiences and instruction prepare students for entry into occupational, technical, or professional education programs.

* **Occupational Information**

  Occupational information and instruction to assist students to discover and develop talents, interest, attitudes, and potential as related to industry and technology.

* **Guidance and Counseling**

  Guidance and counseling activities for students to enable informed and meaningful occupational choices. Arrange for placement in advanced programs.

* **Leadership Development**

  Leadership and citizenship developmental activities shall be provided as an intracurricular portion of the program. American Industrial Arts Student Association (AIASA) membership and benefits should be available and encouraged for all students.

* **Teacher Qualifications**

  The Industrial Arts teacher shall hold a valid Arizona teaching certificate with the appropriate Industrial Arts endorsement, (IAR or IEN) indicating sufficient preparation as specified in the Arizona Industrial Arts Program Standards to implement the specific course(s) to be taught.

* **Competency Lists**

  Arizona-validated competency lists for each program shall be the basis in each program for course development.

* **Student-Teacher Ratio**

  The student-teacher ratio should provide ample opportunity for students and teacher to have information exchange. (General recommended ration of 20-1.)

* **Facilities**

  The facility should be adequately equipped and of sufficient size to provide safe learning stations for all students. (Recommended norm of 100 square feet per student.)

* **Equipment**

  Laboratory equipment shall be compatible with the activities of the course and relevant to current industrial practices.

* **Instructional Supplies**

  Consumable instructional supplies shall be made available to adequately accommodate each student's needs within the scope of the course.

* **Time Allotment**

  Time allotment for each student should provide for ample coverage of course objectives. (Recommended program of 225 minutes per week for 36 weeks. This may be developed utilizing semester courses.)

* **Recommended Program Areas**

  * General Industries
  * Construction
  * Drafting and Design
  * Electricity/Electronics
  * Energy, Power, Transportation
  * Visual Communications
  * Manufacturing

INDUSTRIAL ARTS TECHNOLOGY INSTRUCTIONAL LEVELS

Comprehensive Industrial Arts Technology courses are categorized by level as either awareness, exploratory, or core.

LEVEL I

AWARENESS

Provide introductory experiences related to technology within industry. As a portion of the articulated program, it places major emphasis upon: (1) Learning experiences with tools, materials, and technical processes; (2) Integrating and enriching concepts in English and reading, science, social studies, mathematics, as related to industrial technology; (3) Appreciation of quality and the dignity of all useful work. Specially designed courses with major emphasis upon leisure time, consumer knowledge, project design, and development.

LEVEL II

EXPLORATION

Provide a broad overview of work ethics and employment opportunities within one or more of the Industrial Arts Technology Programs. Participation in actual or job-simulated activities comprise a significant and integral portion of each course. Within an articulated program of Industrial Arts Technology, exploration courses place major emphasis upon: (1) Learning about and using materials, products, and processes of modern industry; (2) Studying and experiencing the organization and management of industry; (3) Role playing in simulated enterprise associated with a number of the occupational clusters; (4) Researching, planning, designing, constructing, and evaluating problems and projects related to various occupational clusters.

LEVEL III

CORE

Provide students with in-depth experiences of work characteristics, work requirements, and employment opportunities, targeted toward particular occupations and technology within a given industrial cluster. Articulated exploratory courses are a prerequisite to core level courses. Major emphasis in core level courses is upon: (1) Developing a knowledge base for educational and occupational planning to prepare for enrollment in advanced technical, occupational, professional education programs; (2) Understanding industry, its place in society, and the free enterprise system; (3) Understanding industrial processes and the practical application of scientific principles; (4) Developing fundamental skills in the proper use of common industrial tools, materials, and processes; (5) Problem-solving involving the materials, processes, and products of industry.

CLASSIFICATION OF INDUSTRIAL ARTS TECHNOLOGY INSTRUCTIONAL PROGRAM TITLES AND CODE NUMBERS

GENERAL INDUSTRIES

21.0001

Designed to provide the student with a broad base of try-out experiences and insights into career opportunities. This provides a basis for personal assessment of work interests and aptitudes. Emphasis is placed upon all of the following:

* Using tools, equipment, materials, and products associated with industry and technology;
* Role playing in simulated enterprise associated with a number of career areas;
* Studying and analyzing the materials, products, processes, problems, uses, developments, and contributions of many of the elements in various career areas;
* Studying the organization of numerous industries and businesses while experiencing typical aspects of many;
* Researching, planning, designing, constructing, evaluating, and generalizing in association with problems and projects related to various careers.

CONSTRUCTION

21.0002

Designed to prepare individuals for enrollment in advanced vocational and technical programs, and provides occupational and basic technical information and hands-on laboratory experiences directly related to current practices in the construction industry.

Fundamentals of construction include the information and basic skills concerned with the erection, installation, maintenance, or repair of residential and industrial structures. Learning activities are centered around building structures using a variety of construction materials and processes involving drafting, design masonry, carpentry, electricity, sheetmetal, and plumbing occupations. Learning experiences include planning, experimenting, constructing, and evaluating construction materials and methods.

DRAFTING AND DESIGN

21.0003

An instructional program that prepares individuals for enrollment in advanced vocational and technical programs and includes occupational and basic technical information and laboratory experiences directly related to drafting in industry. The purpose of the program is to assist individuals in making meaningful occupational and educational choices. Instructional activities involve lettering, freehand sketching, orthographic projection, geometric construction, dimensioning, sectioning, reproduction, pictorial drawing and auxiliary views technical drawing instruments and techniques.

ELECTRICITY/ ELECTRONICS **21.0004**	Instruction in fundamental elements related to electricity and electronics. Occupational and basic technical information and laboratory experiences which relate directly to occupations within the electronic communications industries. Instructional activities include reading and interpreting schematics, setting up experimental apparatus, making measurements, testing circuits, and recording results.
ENERGY, POWER, AND TRANSPORTATION **21.0005**	The study of energy, power, and transportation industries and occupations. Learning experiences with laboratory activities related to energy, power, and transmission, and utilization of power, including theory, maintenance, and service. Emphasis on energy sources, small gas engines, basic electricity, methods of transferring power, and the related socioeconomic and occupational information related to energy, power, and transportation.
VISUAL COMMUNICATIONS **21.0006**	The study of visual communications industry and occupations. Learning experiences and laboratory activities related to industry-oriented communications are provided. Instruction in fundamental elements related to printing, photography, drawing, bindery, screen printing, video, and computer techniques are presented. Basic skills of graphic reproduction using the tools, materials, and processes of the printing industry are developed.
MANUFACTURING **21.0007**	Instruction in fundamental elements related to manufacturing and the processing of materials by industry. Operational and basic technical information and laboratory experiences are directly related to occupations within the manufacturing industry. Occupational information and basic skills related to industrial materials and processes, including properties, utilization, and fabrication. Learning activities involve drafting and design, hand and machine processes, analysis, testing, research, and marketing.
CONSUMER AVOCATIONAL **21.0009**	These are courses designed primarily to provide activities for students to learn basic hand tool and machine operating skills in a safe manner. Included in this category would be courses with major emphasis upon consumer knowledge, leisure time activities, or design and development of a project. This would include what has commonly been referred to as "general shop". This category includes all awareness level industrial arts courses and those exploration courses which do not meet the Industrial Arts Education Program Standards within the preceding programs.

CLASSIFICATION CODE NUMBERS—WHAT THEY MEAN FOR ARIZONA INDUSTRIAL ARTS TECHNOLOGY

21. 0 00 0

Identifies Industrial Arts Technology Program Area.

1. General Industries
2. Construction
3. Drafting & Design
4. Electricity/Electronics
5. Energy, Power, Transportation
6. Visual Communications
7. Manufacturing
8. Consumer--Avocational

Identifies course number within program area as assigned by Arizona Department of Education.

Identifies LEVEL or EMPHASIS of course

1. Awareness level
2. Exploration level
3. Core level
4. Multi-level
5. Applied Science IA course
6. Applied Math IA course
7. Applied Free Enterprise IA course

Identifies INDUSTRIAL ARTS TECHNOLOGY

OFFICIAL STUDENT ORGANIZATION

ARIZONA AIASA

American Industrial Arts Student Association is the national association which serves students in Industrial Arts Technology Education courses. Arizona was one of 17 states initially chartered in 1978 and has continually participated as an active association. AIASA is the only student organization devoted exclusively to the needs of Industrial Arts Technology Education students who are presently enrolled, or have completed, IATE courses.

The mission of AIASA is to develop and deliver a program of activities and supportive services for student members. These activities encourage the development of leadership and personal abilities of students in conjunction with learning about our Industrial/Technical world. State and local chapters in cooperation with the national association provide activities for Industrial Arts Technology Education.

AIASA's mission has been endorsed by the:

United States Department of Education;
American Vocational Association;
National Association of Secondary School Principals;
International Technology Education Association;
National Coordinating Council for Vocational Student Organizations;
Arizona State Board of Education;
Arizona Department of Education;
Arizona Interscholastic Association; and the
Arizona Industrial Education Association.

Each school (Jr. High, Middle, or High School) that has Industrial Arts Technology Education courses is eligible to have an AIASA chapter. The Arizona Department of Education, Division of Vocational Education will provide information and assistance in starting an AIASA chapter upon request.

Arizona AIASA encourages teachers to form chapters as an integral part of Industrial Arts Technology Education programs, thereby providing the opportunity for all students enrolled in Industrial Arts Technology Education courses to become active members of the association.

Each chapter develops its own calendar of activities and service projects. The state association coordinates activities such as leadership conferences and participation of chapter members at the annual national conference.

Information and chapter affiliation materials are available by contacting:

Dr. Macke A. Williams
AIASA State Advisor
1535 West Jefferson
Phoenix, Arizona 85007

Telephone: 255-5565 or
Hot Line 1-800-352-4558